UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Fall River Rural Electric Cooperative, Inc.	)	
	)	P-5089-000
Felt Hydroelectric Project	)	

AMERICAN RIVERS, AMERICAN WHITEWATER, FRIENDS OF THE TETON RIVER, GREATER YELLOWSTONE COALITION, IDAHO CONSERVATION LEAGUE, IDAHO RIVERS UNITED, AND TROUT UNLIMITED'S COMMENTS ON FALL RIVER RURAL ELECTRIC COOPERATIVE'S DRAFT LICENSE APPLICATION FOR THE FELT HYDROELECTRIC PROJECT

Consistent with Federal Energy Regulatory Commission's (FERC) rules and regulations, 18 C.F.R. § 4.38(c)(5), American Rivers, American Whitewater, Friends of the Teton River, Greater Yellowstone Coalition, Idaho Conservation League, Idaho Rivers United, and Trout Unlimited provide comments in response to Fall River Rural Electric Cooperative, Inc.'s (FRE) Draft License Application (DLA) for the Felt Hydroelectric Project (Project), *see* eLibrary no. 20210415-5028 (April 15, 2021).

I.
DESCRIPTION OF COMMENTERS

American Rivers is a nonprofit organization founded in 1973 with a mission of protecting wild rivers, restoring damaged rivers and conserving clean water for people and nature. Based in Washington, DC, American Rivers has over 300,000 members, supporters and volunteers in all 50 states, many of whom live, work and recreate in the Teton River watershed and therefore have a stake in the outcome of the relicensing of the Felt Dam.

American Whitewater is a national non-profit 501(c)(3) river conservation organization founded in 1954. It has over 6,500 members and 100 local-based affiliate clubs, representing approximately 80,000 whitewater paddlers across the nation. American Whitewater's mission is to protect and restore America's whitewater rivers and to enhance opportunities to enjoy them safely. A significant number of our members live near, actively paddle the Project-impacted sections of the Teton River, or would paddle these sections if access were improved.

Friends of the Teton River (FTR) is a non-profit based in Driggs, Idaho with over 1,000 members. FTR works with our community and partners to develop place-based solutions that maintain the viability and health of our working lands and stream corridors, while protecting water resources, improving water quality and stream flows, and restoring functioning fish and wildlife habitat in the Teton River Watershed.

The Greater Yellowstone Coalition is a regional conservation organization based in Bozeman, Montana with offices in Driggs, Idaho and Jackson, Lander and Cody, Wyoming. GYC represents over 90,000 supporters from across the country. Its mission is to work with people to protect the lands, waters, and wildlife of the Greater Yellowstone Ecosystem (GYE), now and for future generations. Its members include residents living in communities across southeast Idaho and visitors enjoying the GYE including the Teton River and its tributaries.

The Idaho Conservation League (ICL) was founded in 1973 as a voice for conservation and protection of Idaho's water, public lands, and wildlife. ICL currently represents approximately 30,000 supporters, many of whom live, work, and/or recreate in the Teton River watershed and have a personal interest in ensuring that water quality and quantity are managed there such that aquatic species and human health are protected.

Idaho Rivers United (IRU) is a state-wide non-profit 501(c)(3) river conservation organization founded over 30 years ago. The mission of IRU is "To protect and restore the rivers of Idaho." IRU has worked on Commission relicensing projects throughout Idaho and represents the interests of its membership and thousands of other Idahoans who look to IRU to advocate for their interests.

Trout Unlimited (TU) is a national non-profit 501(c)(3) fishery conservation organization founded in 1959 and dedicated to conserving, protecting, and restoring North America's trout, salmon, and steelhead and the watersheds upon which they depend. TU's vision is to ensure by the next generation robust populations of native and wild coldwater fish thriving within their North American range, so that our children can enjoy healthy fisheries in their home waters. TU nationwide has over 300,000 members and supporters and that includes over 2,800 members in Idaho. TU has local chapter members in Idaho Falls and the Teton Valley that regularly enjoy fishing and recreating throughout the Upper Snake River Basin including the Teton River.

II. BACKGROUND

The Project is located in Teton County, Idaho, on the Teton River.[1] The river supports a robust coldwater fishery comprised of native Yellowstone cutthroat trout (YCT) and mountain whitefish, along with non-native rainbow trout, brook trout, brown trout, and rainbow trout/cutthroat trout hybrids. Other fish species present include suckers, dace, and sculpins. YCT are designated as a sensitive species by the U.S. Bureau of Land Management (BLM)[2] and

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[1] *Id.* at ¶ 63,496.

[2] Idaho Special Status Animal Species: October 2015, Attachment 2-7, *available at* https://www.blm.gov/sites/blm.gov/files/policies/IDIB2016-003a2.pdf (last accessed Jul. 2, 2021).

U.S. Forest Service (Forest Service),[3] and a Priority Species by the U.S. Fish and Wildlife Service (FWS).[4]

In addition to providing important fish habitat, the Teton River is a unique and sought-after river for paddling and angling.[5] The Project is located at the end of a relatively popular and challenging Class IV-V whitewater run, and at the beginning of a milder Class III(IV) whitewater run that is ideal for rafting and fishing. The project vicinity is the vital access point that allows, and could improve, access for both of these very different reaches.

The Commission issued an original, 40-year license (with an effective date of September 1, 1973) for the Project to FRE on September 9, 1983.[6] The current license expires on August 31, 2023. Under the Federal Power Act (FPA) section 15(c)(1), FRE must file its final license application by August 31, 2021.[7]

The Project as licensed consists of

> a diversion dam, three screened intakes, three tunnels, two penstocks, two powerplants, and a transmission line. Powerhouse #1, located approximately 0.25 miles below the diversion dam, was constructed in 1946, and is expected to be restarted during 2021 after being offline for repair since 2006. Powerhouse #2, located approximately 0.6 miles below the diversion dam, was constructed in 1986 and is currently operating.[8]

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[3] Forest Service – Region 1, Aquatics Sensitive Species List, February 2011 (2011), *available at* https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5366363.pdf (last accessed Jul. 1, 2021), p. 1.

[4] FWS, *Strategic Habitat Conservation in Idaho: A Priority Conservation Strategy 2017* (Attachment 1), *available at* https://www.fws.gov/idaho/documents/SHC/IFWOstrategicframework_20April2016compressed.pdf (last accessed Jul. 1, 2021), p. 8.

[5] American Whitewater, Comments regarding the Preliminary Application Document (PAD) and Request to Use the Traditional Licensing Process, eLibrary no. 20181015-5090 (Oct. 15, 2018) (Attachment 2).

[6] *Fall River Rural Elec. Coop., Inc.*, 24 FERC ¶ 62289, 63495 (1983).

[7] "Each application for a new license pursuant to this section shall be filed with the Commission at least 24 months before the expiration of the term of the existing license." 16 U.S.C. § 808(c)(1).

[8] DLA, p. 3.

It also includes an access road and a public parking area.[9]

The Project occupies lands managed by BLM's Upper Snake Field Office. The lands are managed in accordance with the Resource Management Plan (RMP) for the Medicine Lodge Resource Area:

> The majority of the Felt Hydroelectric Project encumbers lands withdrawn under the Federal Power Act (BLM casefile II-23400 01) and other federal lands administered by the BLM (right-of-way (ROW) casefile IDI-23362). The Felt Hydroelectric Project is one of a variety of multiple uses that the BLM is mandated to manage for.

On August 31, 2018, FRE requested permission to use the Traditional Licensing Process (TLP) for this relicensing, *see* eLibrary no. 20180831-5063. The Commission granted the request on October 23, 2018, *see* eLibrary no. 20181023-3021. FRE conducted a joint meeting on December 13, 2018, *see* eLibrary no. 20181221-5255 (Dec. 21, 2018) (Meeting Summary).[10]

Conservation Groups and the resource agencies submitted comments following the joint meeting requesting additional study and information gathering.[11]

FRE issued a study plan on April 24, 2019, and conducted studies in 2019 and 2020. It issued a study report on January 30, 2020, followed by a study report addendum on December 1, 2020. Stakeholders filed comments in response to FRE's study reports. Several comments

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9 *Id.*

10 FRT separately met with FRE on June 4, 2020 to discuss YCT conservation within the watershed and potential measures to mitigate project impacts on YCT recovery.

11 American Whitewater, Comments regarding the PAD and Request to Use the Traditional Licensing Process, eLibrary no. 20181015-5090 (Oct. 15, 2018) (Attachment 2); BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019); Idaho Department of Environmental Quality, Study Requests, eLibrary no. 20190211-5108 (Feb. 8, 2019); IDFG, Letter to Kimberly D. Bose re: Pre-Application Document, eLibrary no. 20190211-5163 (Feb. 11, 2019); NPS, Study Requests, eLibrary no. 20190211-5010 (Feb. 8, 2019); USFS, Letter to Nicholas E. Josten re: Felt Hydroelectric Project (FERC No. 5089) Study Requests and Comments, eLibrary no. 20190307-5128 (Feb. 8, 2019); and Friends of the Teton River, Study Requests, eLibrary no. 20190211-5183 (Feb. 11, 2019) (Attachment 3).

reiterated previous study and information requests that had not been adequately addressed by FRE (*see* Sections III.C.2.a and III.C.2.b, *infra*).

III.
COMMENTS

The Commission requires that an applicant proceeding under the TLP file a copy of its draft application that:

> (A) Indicates the type of application the potential applicant expects to file with the Commission; and
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> (B) Responds to any comments and recommendations made by any resource agency and Indian tribe either during the first stage of consultation ….”[12]

The applicant also is required to file the

> results of all studies and information-gathering either requested by that resource agency or Indian tribe in the first stage of consultation … or which pertain to resources of interest to that resource agency or Indian tribe and which were identified by the potential applicant …, including a discussion of the results and any proposed protection, mitigation, or enhancement measures.[13]

Relicensing participants are to use this information to identify points of potential disagreement with the licensee’s proposal.[14] The licensee is then to take steps to resolve in advance of filing the final license application (FLA).[15]

We have identified several study and potential substantive disputes based on our review of the DLA. The DLA relies on incomplete or outdated data to argue in favor of a new license based on essentially the same terms as the existing license. In other words, FRE argues that

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[12] 18 C.F.R. § 4.38(c)(4)(i).

[13] 18 C.F.R. § 4.38(c)(4)(ii).

[14] 18 C.F.R. § 4.38(c)(5).

[15] 18 C.F.R. § 4.38(c)(6).

continuation of the status quo for the next 30-50 years *probably* will not result in any worsening of baseline conditions. This does not comply with FRE's responsibilities as the applicant, and the Commission's procedural and substantive duties under the FPA.

A. <u>The DLA Does Not Provide Adequate Information to Support Findings of Fact by the Commission.</u>

Under FPA section 313(b), the Commission's findings of fact will be upheld only *if* supported by substantial evidence.[16]

Further, the Commission, as the lead agency under the National Environmental Policy Act (NEPA), 42 U.S.C.§ 4332, must ensure the "professional integrity, including scientific integrity, of the discussions and analyses in environmental documents" (40 C.F.R. § 1502.23).

While it is ultimately the Commission's responsibility for assuring it has substantial evidence to support its findings in the NEPA document and final licensing decision, the Commission requires that the license applicant assist its Office of Energy Projects (OEP) Staff to develop reliable data for purposes of evaluating its proposal and reasonable alternatives. The license applicant must

> (1) Provide all necessary or relevant information to the Commission; [and]
>
> (2) Conduct any studies that the Commission staff considers necessary or relevant to determine the impact of the proposal on the human environment and natural resources….[17]

OEP Staff may require the license applicant to provide additional information if the FLA does not provide an adequate basis for environmental review under NEPA. As described in Section III.C., *infra*, additional information is needed here.

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16 *See* 16 U.S.C.§ 825*l*(b); *see also* 5 U.S.C. § 706(2)(A).

17 18 C.F.R. § 380.3(b)(1)-(2).

B. <u>The DLA Does Not Support A Finding that the Project as Licensed Will Be Best Adapted to a Comprehensive Plan of Development for the Teton River.</u>

Under FPA section 10(a), the Commission must find that the project as licensed will balance multiple beneficial uses to best serve the public interest and may require changes to the applicant's proposal as necessary to make this finding. The statute provides:

> That the project adopted, including the maps, plans, and specifications, shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 797(e) of this title [and] if necessary in order to secure such plan the Commission shall have authority to require the modification of any project and of the plans and specifications of the project works before approval.

In making its best adapted determination under FPA section 10(a), the Commission must give equal consideration to non-power uses of the waterway under FPA section 4(e):

> In deciding whether to issue any license …, the Commission, in addition to the power and development purposes for which licenses are issued, shall give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.[18]

Under FPA section 4(e), the Commission must also find "the license will not interfere or be inconsistent with the purpose for which such reservation [, here the Medicine Lodge Area,] was created or acquired."[19]

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[18] 16 U.S.C. § 797(e).

[19] *Id.*

As described below, the DLA does not provide adequate information to show the Project as proposed by FRE will be best adapted to a comprehensive plan of development. Further, the DLA does not show FRE has adequately considered non-power uses of the Teton River.

C. <u>Additional Studies Are Needed to Assure an Adequate Record for Relicensing.</u>

As described above, the DLA does not provide adequate information to support evaluation of FRE's proposal, let alone a determination that the proposal would be best adapted to a comprehensive plan of development for the Teton River as compared to alternatives. The DLA relies heavily on data gathered decades ago without showing the data accurately reflect current conditions or is representative of potential future conditions.

FRE has declined to undertake studies the resource agencies and Conservation Groups have identified as necessary to provide adequate information for the relicensing. As BLM stated, "[t]he final study plan, dated April 24, 2019, disregarded many of the stakeholder study requests and did not provide sufficient rationale for doing so."[20]

For example, FRE's fish passage and entrainment studies are not adequate to show the Project is meeting or will meet the National Oceanic and Atmospheric Administration's guidance for Anadromous Fish Passage Facility Design (NOAA Criteria), *available at* https://repository.library.noaa.gov/view/noaa/23894 (last accessed Jul. 1, 2021),[21] which provides modern industry standards for fish passage and entrainment, even though BLM and

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[20] Letter to Kimberly Bose, Re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), p. 1.

[21] NOAA's guidance "provides criteria, rationale, guidelines, and definitions for the purpose of designing proper fish passage facilities for the safe, timely, and efficient upstream and downstream passage of anadromous salmonids at impediments created by artificial structures, natural barriers (where provision of fish passage is consistent with management objectives), or altered instream hydraulic conditions." *Id.* at viii-ix.

other stakeholders requested that FRE use NOAA Criteria.[22] Using the NOAA Criteria will ensure that the information collected will provide a reliable scientific basis for the Commission's environmental analysis.

We describe the data gaps in the record regarding project effects on fisheries and recreational resources below. These gaps must be completed for the Commission, resource agencies, and other stakeholders to be able to evaluate FRE's proposal and alternatives. Only two months remain until FRE must file the FLA in accordance with the statute. We recognize this deadline cannot be extended and that there is insufficient time for FRE to complete needed studies and consider the results in the FLA. However, the fact that studies cannot be completed prior to the filing of the FLA does not obviate the need for the studies. FRE should work to reach agreement with the resource agencies and other stakeholders regarding needed studies and methodology for conducting those studies, and plan to update or amend the license application once the studies are completed.

1. <u>Fisheries</u>

As stated above, there are several fish species present in the Teton River that are affected by the ongoing presence and operation of the Project. The record does not provide adequate information to develop appropriate measures to minimize or mitigate project impacts on these fish resources.

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[22] BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020); BLM, Letter to Kimberly Bose re: Study Report Addendum – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20210201-5011 (Jan. 29, 2021).

Information in the record shows the Project is contributing to a decline of YCT in the watershed.[23] This decline has warranted YCT's designation as a species of concern and may contribute to a listing under the federal Endangered Species Act over the term of any new license.[24] More specifically, the data show: (1) the screens do not adequately prevent YCT from becoming entrained in the intakes and causing significant trout mortality in the turbines; (2) the fish ladder and dam are significantly inhibiting fish passage; and (3) the minimum flows in the bypass reach do not provide adequate suitable habitat and fish passage year-round for all native fish species.

Addressing project impacts to YCT over the term of any new license is a priority because the Teton River Watershed is considered one of the last, best stronghold watersheds for YCT

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[23] Habitat degradation and fragmentation, climate change, non-native species, hybridization, and overharvest are all factors that have led to the decline of YCT and continue to threaten the last of the YCT stronghold populations. Robert Al-Chokhachy et al., "Status & Conservation of Yellowstone Cutthroat Trout in the Greater Yellowstone Area" (Jan. 2017), *available at* https://www.researchgate.net/publication/317290167_Status_and_Conservation_of_Yellowstone_Cutthroat_Trout_in_the_Greater_Yellowstone_Area (last accessed Jul. 1, 2021)(Attachment 4); *see also* Carol Endicott et al., "Range-Wide Status Assessment for Yellowstone Cutthroat Trout (Oncorhynchus Clarkii Bouvieri): 2012" (Mar. 9, 2016), *available at* https://westernnativetrout.org/wp-content/uploads/2019/06/Rangewide-YCT-Status-Assessment-2012-Final.pdf (last accessed Jul. 1, 2021)) ("the Yellowstone cutthroat trout populations in the Lower Snake GMU face many threats that need to be addressed to ensure that healthy, vibrant populations persist into the future.").

[24] FWS last reviewed a petition to list the YCT as threatened in 2006. *See* 71 Fed. Reg. 8818-01 (2006). At the time, FWS found the listing was not yet warranted. That does not mean that the species is stable: "the historical record indicates the distribution of YCT has been substantially reduced over the past 200 years." *Id.* at 14. There are a variety of reasons for this decline:

> Declines in populations of native salmonids may result from the combined effects of habitat degradation and fragmentation, **the blockage of migratory corridors**, declining water quality or quantity, angler harvest and poaching, **entrainment** (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, introduced nonnative species, or other impacts... Examples of specific land and water management activities that depress salmonid populations and degrade habitat include **dams and other diversion structures**, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development.

Id. at 4 (emphasis added).

across their range.[25] The FWS has identified restoring YCT populations and riverine habitats as a primary resource objective, and established the following specific goals for restoring YCT to the Middle Rockies Priority Landscape: "[e]nsure abundant, diverse (including life histories), and resilient populations of Priority Species within the riverine/riparian habitats of the Middle Rockies Priority Conservation Area" and "[p]romote connectivity between important habitat patches for Priority Species."[26] To achieve the stated goals, FWS recommends taking action to "[r]emove passage barriers…influencing Yellowstone cutthroat distribution: a) culvert replacements, b) fish ladder installation, c) fish screen installation."[27]

Relicensing of the Project should also address the objectives and strategies of Idaho Fish and Game's (IDFG) Fisheries Management Plan for the Teton River,[28] and the National Fish

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25 IDFG, *Fisheries Management Plan 2019-2024* (June 2019), *available at* https://idfg.idaho.gov/sites/default/files/2019-2024-idaho-fisheries-management-plan-original.pdf (last accessed Jul. 1, 2021), p. 327; Montana Fish, Wildlife & Parks et al., Range-Wide Status Assessment for YCT (*Oncorhynchus clarkia bouvieri*): 2012 (2016), *available at* https://westernnativetrout.org/wp-content/uploads/2019/06/Rangewide-YCT-Status-Assessment-2012-Final.pdf (last accessed Jul. 1, 2021), p. i. ("YCT currently occupy only 43% of their historic range and are genetically unaltered in only 23% of their historic range."). *See also* 71 Fed. Reg. 8818-01, 2006, p. 7:

> Although YCT distribution has declined, perhaps by more than 50 percent over the past 200 years (May et al. 2003), our analysis indicates that YCT strongholds remain in at least three major watersheds of the upper Yellowstone River basin and six major watersheds of the upper Snake River basin. These nine HUCs collectively form a solid basis for persistence of conservation populations of YCT.

26 FWS, *Strategic Habitat Conservation in Idaho: Landscape Conservation Strategy* (2016) (Attachment 1), *available at* https://www.fws.gov/idaho/documents/SHC/IFWOstrategicframework_20April2016compressed.pdf (last accessed Jul. 1, 2021), p. 7.

27 *Id*. at 24.

28 IDFG, *Fisheries Management Plan 2019-2024* (June 2019), *available at* https://idfg.idaho.gov/sites/default/files/2019-2024-idaho-fisheries-management-plan-original.pdf (last accessed Jul. 1, 2021). Specifically, IDFG's listed objectives are to:

- Restore connectivity to improve spawning, rearing migration success of Yellowstone Cutthroat Trout.
- Identify tributaries with minimal risk of invasion by non-native species as candidates for improving connectivity.

Habitat Partnership's objective to "[r]everse declines in the quality and quantity of aquatic habitats to … improve ecological condition, restore natural processes, or prevent the decline of intact and healthy systems leading to better fish habitat conditions."[29]

a. Entrainment

According to the DLA, the Project poses a risk of entrainment:

> Fish present in the forebay above Felt dam are susceptible to becoming entrained through the project fish screens, penstocks and turbines resulting in partial mortality. The number of fish entrained through the project depends on multiple factors, some of which are not known. Of those fish entrained a relatively small percentage are killed during passage through the project turbines and the rest are returned to the river alive via the powerhouse discharge. Thus the overall fish loss due to the interaction with the project facilities depends on:
>
> - Fish population
> - Fish movement
> - % of river flow passing through powerplants
> - Screen effectiveness
> - Turbine mortality rates.[30]

This "small percentage" is almost 30% mortality at Powerhouse #2, and 15% mortality at Powerhouse #1 when it is operating:

> Analysis suggests that entrainment through the Felt fish screens is likely to occur, mainly for fish smaller than 3.9 inches. Entrained fish would likely consist primarily of Rainbow Trout and would mainly pass through Powerhouse #2 where they would be subject to approximately 29% mortality. During May to July some fish would also pass through Powerhouse #1 where they would be subject to approximately 14.8% mortality.[31]

- Minimize loss of juvenile fish to irrigation diversions where these losses are deemed to be having a population-level impact on the resource.
- Obtain adult fish passage around/through hazards, barriers, and blockages (in this case, "entrainment" hazard).

Id. at 328.

29 National Fish Habitat Partnership, National Fish Habitat Action Plan: 2nd Edition (Jul. 2012), *available at* http://www.fishhabitat.org/about/action-plan/national-fish-habitat-action-plan-2nd-edition (last accessed Jul. 1, 2021), p. 4.

30 DLA, p. 43.

31 *Id.* at 45.

FRE proposes inspection and repair of screens over the term of the new license, but does not propose any other measures to reduce the existing entrainment or fish mortality:

> Overall, the Felt fish screen is not a complete barrier to fish entrainment; some entrainment and turbine mortality doubtless occurs. However, the screen constitutes an effective partial barrier, especially to larger fish. In combination with other fishery mitigation measures, the screen has been effective in maintaining stable salmonid populations in the project reach since these measures were first implemented under the original FERC license. With continued fish stocking and proper maintenance of the intake fish screen, operation of the project under a new license should not result in any increase to entrainment and turbine mortality.[32]

IDFG has commented on the importance of appropriate screening to address fish mortality: "[a]ppropriately designed and effective intake screening is critical to minimize turbine-related fish mortality due to impingement and entrainment."[33] It has expressed concern that FRE's studies to date provide an insufficient basis for addressing impingement and entrainment-related fish mortality at the Project:

> IDFG identified the following study concerns, which hinder a full understanding of project impacts on fish mortality and corresponding mitigation needs to ensure a healthy public fishery:
>
> - No project-specific estimates of fish mortality due to impingement or entrainment are provided.
> - Approach and sweeping velocities, which determine fish impingement and entrainment, were empirically measured for the existing fish screen only at a flow rate of 500 cfs.
> - Data collection did not consider both Powerhouses #1 and #2 simultaneously operating at a cumulative flow rate of 900 cfs, which is proposed for the new license.

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[32] *Id.*

[33] IDFG, Letter to Kimberly D. Bose, Re: 2020 Study Report; Felt Hydroelectric Project FERC No. 5089, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2.

- The literature review and modeling of bull trout length/head widths in the Little Lost River is insufficient for estimating project-related fish mortality, because of difference in river function and important morphological differences between bull trout (absent in the Teton River) and fish species within the project reach.[34]

IDFG has requested additional studies to address fish mortality caused by the Project:

> The study provides no empirical estimates of turbine-related fish mortality due to impingement and entrainment for the projects full proposed operating range up to 900 cfs. Therefore, IDFG recommends the following study improvements to understand fish mortality during operation of both powerhouses:
>
> - Empirically measure approach and sweeping velocities at the fish screen for the project's full existing and potential operating ranges up to 900 cfs ….
>
> - Coordinate with IDFG to develop methodologies to accurately assess fish mortality due to impingement and entrainment for the projects full existing and potential operating ranges, particularly if empirically achieving flow rates up to 900 cfs is infeasible during the study.[35]

FTR similarly requested additional study of project entrainment on fish. During site visits in 2020 and 2021, FTR found numerous adult trout behind the fish screens and noted that the mesh screens that were placed between the screens and the cliff/bank abutments were in disrepair and probably had been for many years. FTR further noted that it was difficult to ascertain the condition of the screen spacing or the condition of the bottom of the screen without a dive inspection and that it was likely that entrainment in the intakes and that mortality from impingement on the screens for migrating juvenile trout could be significant given high approach velocities and spacing of the screen openings.[36] The observed conditions raise concerns that FRE may not be compliant with its current license mitigation requirements given that the fish

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[34] *Id.*

[35] IDFG, Letter to Kimberly D. Bose, Re: 2020 Study Report; Felt Hydroelectric Project FERC No. 5089, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2.

[36] FRE, 2020 Study Report, Appendix E, p. 3.

screen is in disrepair and does not effectively screen even adult-sized fish from the intakes. It further heightens concerns regarding the lack of specificity in the DLA's proposed mitigation measure to inspect fish screens.

FRE states in the DLA (p. 67) that it did not conduct the requested entrainment studies due to high study costs. However, FRE did not provide information to demonstrate the study costs were prohibitive or that other data was adequate to support its claim entrainment was not significant.[37] We recommend FRE use the same methods for estimating mortality in Francis turbines as it used in the 2020 Study Report, but use only YCT head/lengths from a YCT head/length study instead of bull trout head/lengths.

Along with several of the agencies, we request that FRE study the following aspects of the fish screen structure as part of relicensing: (1) determine where trout are passing around the screens and determine the spacing between the fish screen bars across the entire screen;[38] (2) determine if the sweeping and approach velocities on the entire fish screen at different levels of intake flow operation including maximum intake flow with both powerhouses in operation (maximum intake flow may need to be estimated) meet NOAA Criteria for sweeping and

[37] Under NEPA implementing regulations, the Commission will be expected to obtain information relevant to evaluating project impacts unless it shows the costs of obtaining it would be unreasonable: "If the incomplete but available information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives, and the overall costs of obtaining it are not unreasonable, the agency shall include the information in the environmental impact statement." 40 C.F.R. § 1502.21(b).

[38] *See also* BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019), pp. 9-10 (requesting a study on fish movement and fish passage through the existing screen spacing); BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), p. 6 (requesting a complete and accurate description of screen structure); BLM, Letter to Kimberly Bose re: Study Report Addendum, eLibrary no. 20210201-5011 (Jan. 29, 2021), pp. 6-7 (requesting the same); IDFG, Letter to Kimberly D. Bose re: Pre-Application Document, eLibrary no. 20190211-5163 (Feb. 11, 2019), p. 2 (requesting that FRE meet screen-spacing mitigation standards or conduct a fish entrainment and mortality study).

approach velocities;[39] (3) determine the size of YCT that are likely entrained by studying the size of YCT located in the vicinity of the Project (and not by cross-referencing a bull trout study since body size is variable between species and even within the same watershed);[40] and (4) determine the turbine mortality rates based upon turbine type, and size of trout entrained.[41] If the studies show mortality for YCT exceeds NOAA Criteria, FRE should modify its proposal to include mitigation measures that are intended to meet the NOAA Criteria. Additionally, FRE should use the study results to develop a plan for inspecting, repairing, cleaning, and maintaining the fish screen subject to the review and approval of IDFG, FWS, and OEP Staff.

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[39] *See also* BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019), p. 10 (requesting estimates on sweeping velocities); BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), p. 9 (requesting the same); BLM, Letter to Kimberly Bose re: Study Report Addendum, eLibrary no. 20210201-5011 (Jan. 29, 2021), p. 10 (requesting the same); USFS, Letter to Nicholas E. Josten re: Felt Hydroelectric Project (FERC No. 5089) Study Requests and Comments, eLibrary no. 20190307-5128 (Feb. 8, 2019), p. 2 (requesting an estimate of sweeping velocity for the existing fish screen); IDFG, Letter to Kimberly D. Bose re: 2020 Study Report, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2 (requesting empirical measurements of approach and sweeping velocities at the fish screen).

[40] *See also* BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019), p. 10 (requesting a study on the sizes of fish impinged on the screen face); BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), p. 8 (requesting trapping efforts to assess timing, species, and size composition of fish); BLM, Letter to Kimberly Bose re: Study Report Addendum, eLibrary no. 20210201-5011 (Jan. 29, 2021), pp. 8-9 (requesting the same); USFS, Letter to Nicholas E. Josten re: Felt Hydroelectric Project (FERC No. 5089) Study Requests and Comments, eLibrary no. 20190307-5128 (Feb. 8, 2019), p. 2 (requesting a study of the fish entrainment by age class); IDFG, Letter to Kimberly D. Bose re: Pre-Application Document, eLibrary no. 20190211-5163 (Feb. 11, 2019), p. 3 (requesting quantification of current fish entrainment and mortality); IDFG, Letter to Kimberly D. Bose re: 2020 Study Report, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2 (requesting an appropriately designed intake study that does not conflate bull trout and YCT).

[41] *See also* BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019), p. 10 (requesting a study on turbine mortality rates by turbine type and fish age class); BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), pp. 9-10 (requesting the same); BLM, Letter to Kimberly Bose re: Study Report Addendum, eLibrary no. 20210201-5011 (Jan. 29, 2021), p. 10 (requesting the same); USFS, Letter to Nicholas E. Josten re: Felt Hydroelectric Project (FERC No. 5089) Study Requests and Comments, eLibrary no. 20190307-5128 (Feb. 8, 2019), p. 2 (requesting a review of turbine mortality rates by age class); IDFG, Letter to Kimberly D. Bose re: 2020 Study Report, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2 (requesting an empirical review of turbine-related fish mortality).

b. Passage

According to the DLA, "[t]he Felt Dam fish ladder was constructed in 1986 as part of the original 1983 FERC license and 1985 license amendment for the Felt Project. Prior to 1986 Felt dam was a complete barrier to upstream fish passage beginning with its construction in the early 1900s."[42] FRE conducted new fish passage studies at the ladder during 2019 and 2020 to supplement studies conducted in 1987-1988 and 1998-1999.[43] Based on these studies, the DLA finds that the fish ladder provides effective passage at the Project:

> Overall study results indicate that the Felt Dam fish ladder provides consistent passage upstream past Felt Dam. The ladder is well designed for passing the existing minimum flows. False attraction flows are minimal when the project operates at minimum flow but are more significant at higher bypass flows. Recommissioning of Powerhouse #1, which should be completed in 2021, will further reduce the amount of time that the radial gate and/or spillway pass excess water that could function as a false attractant. The project proposal to continue ladder maintenance and existing minimum flow requirements should result in effective operation of the fish ladder during the term of a new license.[44]

IDFG has stated the importance of fish passage to protection of fish populations in the project area: "[e]fficient and effective two-way passage of fish around the dam is necessary for population connectivity."[45] It also has stated concern that FRE's studies to date do not provide adequate information to address project impacts on passage:

> IDFG identified the following study concerns, which hinder a full understanding of project impacts on population connectivity and corresponding mitigation needs to ensure a healthy public fishery:

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[42] DLA, p. 37.

[43] *Id.*

[44] DLA, p. 43.

[45] IDFG, Letter to Kimberly D. Bose, Re: 2020 Study Report; Felt Hydroelectric Project FERC No. 5089, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 1.

- Fish ladder passage efficiency and effectiveness was not estimated thereby limiting critical inferences about population connectivity and potential barrier effects of the dam.

- Not all fish captured using the fish ladder were taxonomically identified to species.

- Although the intent is to continue to operate the ladder's fish trap through June 2020, the study will not provide (1) taxonomic data for all species captured or (2) passage efficiency and effectiveness estimates during a full annual cycle (e.g., the Yellowstone cutthroat trout and rainbow trout spawning season).[46]

IDFG has stated that additional study is needed:

> Recommendations – Although some fish move through the ladder, the study provides incomplete estimates of seasonal and annual passage efficiencies and effectiveness for all fish species (e.g., the rare bluehead sucker). IDFG therefore recommends the following study improvements:
>
> - Continue to operate the ladder's fish trap until a full year of data has been collected during which all captured fish are identified to the species level so that ladder use can be recorded for the entire fish community (e.g., bluehead sucker).
>
> - Estimate the ladders seasonal and annual fish passage efficiencies and effectiveness of marked samples (i.e., with electrofishing) of fish in the bypass reach to assess population connectivity and potential barrier effects created by the dam (e.g., inadequate and disorienting attraction flows).[47]

The Conservation Groups have similarly commented on the need for additional studies related to the impacts of the Project on fish passage, especially passage of YCT. We previously commented that the Project's impact on passage has been acknowledged for several decades:

> In 1985 when the dam was rebuilt and the fish ladder was installed, IDFG and project Stakeholders acknowledged that the facility was impacting YCT populations. In a 1985 IDFG letter to Bingham Engineering, IDFG stated "We do believe the migration barrier created by Felt Dam was (and is) the major cause for the loss of adfluvial [fluvial] cutthroat trout in Teton Basin."[48]

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[46] *Id.*

[47] IDFG, Letter to Kimberly D. Bose, Re: 2020 Study Report; Felt Hydroelectric Project FERC No. 5089, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2.

[48] "Friends of the Teton River (FTR) Comments on Fall River Electric 2020 Study Report Addendum 2-22-21," eLibrary no. 20210303-5126 (Mar. 3, 2021), p. 3.

The presence of the dam has limited the upstream migration of YCT that historically occurred.[49] This has caused or contributed to a delineation between YCT populations above and below the dam: "There has been a genetic divergence between the Teton River Canyon YCT and the Upper Teton River YCT.[50] According to IDFG, this divergence could have started in 1921 when the dam was constructed. The separating point between the two populations appears to be at Felt Dam."[51]

According to historical migration data from the South Fork of the Snake River and studies of Teton River Canyon and Bitch Creek, it was likely that there was a spawning run that numbered in the tens of thousands of individuals since there is nothing to preclude YCT from migrating upstream to abundant spawning habitat in the Upper Teton River Watershed.[52] On the South Fork of the Snake River, fluvial YCT migrate long distances to spawn in tributary headwaters.[53] Currently, FTR estimates that approximately 5,000 fluvial YCT migrate from Teton River Canyon into Bitch Creek to spawn each spring (FTR, 2005-2016 Teton River Watershed Fisheries Report, FTR (Feb. 20, 2017)).

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49 *See id.* ("In the past, YCT had to migrate through the Teton River Canyon to colonize the Upper Teton River Watershed.").

50 Memorandum from Matthew Campbell et al., IDFG to Dan Garren et al. Re: Genetic Results of screening YCT from the Teton River Drainage, Campbell, (Jan. 10, 2018) (Attachment 5).

51 "Friends of the Teton River (FTR) Comments on Fall River Electric 2020 Study Report Addendum 2-22-21," eLibrary no. 20210303-5126 (Mar. 3, 2021), p. 3.

52 Friends of the Teton River, Study Requests, eLibrary no. 20190211-5183 (Feb. 11, 2019) (Attachment 3); Friends of the Teton River, Comments on FRE 2020 Study Report Addendum, eLibrary no. 20210303-5126 (Feb. 22, 2021); IDFG Fishery Management Annual Report (Jul. 2016), *available at* https://collaboration.idfg.idaho.gov/FisheriesTechnicalReports/Forms/AllItems.aspx (last accessed Jul., 2021), p. 108.

53 IDFG, Fishery Management Annual Report (July 2016), p. 108.

In contrast, during the most comprehensive fish trap effort on the fish ladder to date, FRE found only nine fluvial size YCT in the fish ladder fish trap in 2020 during the known YCT spawning season. Further, none of the previous fish ladder studies found any fluvial YCT during the known spawning season. During a 1998-1999 fish movement study on Teton River, IDFG telemetry tagged and tracked YCT and rainbow trout in Teton River Canyon. During the study, IDFG did not track any tagged fish moving up stream of the Felt Dam. It attributed this, in part, to habitat fragmentation caused by the Felt Dam: "Numerous irrigation diversion structures in the Lower Teton … and Felt Dam in the Teton Canyon have probably further fragmented and isolated these [trout] populations."[54]

FRE has not shown that fish passage at the dam is adequate for YCT let alone other native fish species. To the contrary, the data suggests that the dam has been and continues to be an almost complete barrier to spawning YCT which has contributed to the decline in the species in the Teton River Watershed and across their range.

The Forest Service has commented that Felt Dam and other barriers have contributed to the decline of YCT within the Teton River watershed:

> The Teton River is known to support large, fluvial, migratory YCT that reside in the mainstem Teton River but migrate upstream to spawn and complete their lifecycle, including migrating and spawning in the upper Teton River tributaries located within the Caribou-Targhee National Forest. Disruptions of these life history patterns due to dams and diversions are one of the factors leading to the decline of YCT and their resulting sensitive species designation. The Felt Hydroelectric facility was known to be a complete barrier to fish from the early 1900's [1921] until 1986 when a fish ladder was installed (IDFG, Shrader et al. 2002). After decades of no upstream passage, migratory life history patterns between the lower and upper river likely disappeared. It is the Forest Service's goal to restore and maintain the migratory connection for spawning YCT.[55]

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[54] IDFG, Teton River Investigations Part III: Fish Movements and Life History 25 Years After Teton Dam, December 2004, *available at* https://collaboration.idfg.idaho.gov/FisheriesTechnicalReports/Res04-45Schrader2002%20Teton%20River%20Investigations,%20Part%203.pdf (last accessed Jul. 1, 2021), p. 12.

[55] USFS, Letter to Nicholas E. Josten re: Felt Hydroelectric Project (FERC No. 5089) Study Requests and Comments, eLibrary no. 20190307-5128 (Feb. 8, 2019), p. 1.

BLM has similarly stated the importance of restoring habitat connectivity to the protection of YCT: "Ensuring connectivity among YCT in the Teton River Canyon and the headwaters may be essential for long-term viability of YCT in the Teton River Watershed."[56]

Information in the record indicates the Project continues to contribute to impacts on YCT movement in two primary ways: (1) YCT migrating to abundant spawning and rearing habitat in the upper watershed encounter difficulty finding and using the fish ladder likely due to lack of attractive flows, ineffective design and frequent plugging of the ladder; and (2) as described above, it is likely that a significant percentage of out-migrating juvenile YCT experience mortality at the Project either through impingement on the screens or mortality in the turbines.

It is critical that the Project is carefully evaluated using NOAA Criteria for YCT and other native fish migration issues so the Commission can fully evaluate the Project's impacts on fish over the term of any new license and develop and consider alternative measures that would avoid, minimize, or mitigate those impacts. If ongoing conservation efforts within the watershed are successful in the coming years, there may be more YCT seeking to migrate up- and downstream of the Project. Any new license should ensure that the Felt Dam does not undermine or defeat the significant restoration efforts underway in the watershed.

The Commission's NEPA document should also address the increased significance of project impacts on YCT and other native fish in light of climate change.[57] The effects of climate

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56 BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019).

57 *See* Steven Hostetler and Jay Alder, The Greater Yellowstone Climate Assessment: Chapter 7: Future Water Projections for the Greater Yellowstone Area (Jun. 2021), *available at:* https://www.gyclimate.org/ch7 (last accessed Jul. 1, 2021). Projections suggest increased summer water deficits of 16% in the Upper Snake watershed by mid-century, and up to 24% by the end of the century. While drastic, these increases are at the lower end for projected water deficits throughout the GYA, making the Upper Snake a critical refuge for vulnerable YCT. These

change are likely to increase temperatures to less than optimal conditions for YCT in portions of Lower Teton River and the Henry's Fork, in which case YCT will need to migrate through the Project to cold water refugia in the upper watershed.[58]

FRE's studies along with past studies have shown that the fish ladder does pass some fish; however, the existing studies do not evaluate the effectiveness of the fish ladder at passing adult YCT and other native fish under different conditions. Further fish passage study is needed to determine if the fish ladder meets NOAA Criteria.[59] Such a study should determine (1) the extent to which the fish ladder inhibits migration of native fish and (2) determine the extent to which fish moving upstream are delayed or unable to find the entrance to the ladder due to insufficient attractant flows and/or if there are other fish ladder design issues. In the spring of 2021 during spring run-off and within the YCT spawning season, FTR and BLM observed that fish ladder attractive flows were exceptionally low compared to flows at the radial gate and, given the small entrance size to the ladder and low attractive flows, that it would be very difficult for a fish to find the entrance to the fish ladder.

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deficits correlate to earlier peak runoff, causing lower minimum streamflows to occur "earlier in the year in combination with projected warmer air and likely warmer water temperatures."

[58] Al-Chokhachy et al., The Interactive Effects of Stream Temperature, Stream Size, and Non-native Species on Yellowstone Cutthroat Trout (Apr. 8, 2020) (Attachment 6), *available at* https://cdnsciencepub.com/doi/abs/10.1139/cjfas-2020-0408 (last accessed Jul. 1, 2021). Studying the project and implementing effective mitigation measures is considered to be an essential part of the community-based YCT recovery effort and is currently considered by FTR and others to be the highest priority project for YCT conservation in the watershed.

[59] *See also* BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019), pp. 7-8 (requesting a more thorough understanding of ladder efficacy for fish passage); BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), pp. 7-8 (requesting the same); BLM, Letter to Kimberly Bose re: Study Report Addendum, eLibrary no. 20210201-5011 (Jan. 29, 2021), p. 9 (requesting the same); USFS, Letter to Nicholas E. Josten re: Felt Hydroelectric Project (FERC No. 5089) Study Requests and Comments, eLibrary no. 20190307-5128 (Feb. 8, 2019), p. 2 (requesting the same); IDFG, Letter to Kimberly D. Bose re: 2020 Study Report, eLibrary no. 20200313-5092 (Mar. 13, 2020), pp. 1-2 (requesting the same).

In addition to studying the effectiveness of the fish ladder for specific species under the anticipated range of operating and environmental conditions, FRE should gather information necessary to develop a proposed plan for cleaning the fish ladder, which is frequently plugged during the known YCT spawning season. The plan should be developed and implemented in consultation with IDFG and FWS and include a fish ladder maintenance schedule and reporting requirements. It appears that cleaning of the fish screen may be a source of debris that plugs the fish ladder. If that is the case, FRE should also develop a plan for disposal of fish screen debris or installation of a debris deflector upstream from the fish ladder.

The Conservation Groups also request that FRE evaluate seasonal minimum flows in the bypass reach to determine if the flows and water temperature meet NOAA Criteria for fish passage.[60] FRE should show how any flows and associated temperatures it is proposing will provide adequate fish passage through the bypass reach, especially during YCT migration time periods and during the hot summer months when fish are/or will be potentially moving to cold water refugia.

Based on our collective experience and consultation with the resource agencies, we believe the requested studies would be economically feasible to complete; FRE has not shown otherwise. For example, to study the effectiveness of the fish ladder at passing native adult fish,

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[60] *See also* BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019), pp. 9-10 (recommending continuous water temperature monitoring); BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), pp. 7-8 (requesting study on ladder functionality under varying flow conditions), pp. 10-11 (requesting additional water temperature monitoring); BLM, Letter to Kimberly Bose re: Study Report Addendum, eLibrary no. 20210201-5011 (Jan. 29, 2021), pp. 7-8 (requesting additional estimates of bypass flow), pp. 11-12 (requesting modified water temperature monitoring); USFS, Letter to Nicholas E. Josten re: Felt Hydroelectric Project (FERC No. 5089) Study Requests and Comments, eLibrary no. 20190307-5128 (Feb. 8, 2019), p. 2 (requesting a study on water quality impacts of the dam on stream temperatures); IDFG, Letter to Kimberly D. Bose re: Pre-Application Document, eLibrary no. 20190211-5163 (Feb. 11, 2019), pp. 1-2 (requesting additional information on water temperature and minimum flows in the bypass reach); IDFG, Letter to Kimberly D. Bose re: 2020 Study Report, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2 (recommending further assessment of varying flows).

fish located upstream and downstream of the ladder would be captured using electro-fishing equipment and hook and line gear and then each fish would be Passive Integrated Transponder (PIT)-tagged. PIT-tag antennas (Interrogation Sites) would be installed near the bottom of the fish ladder, in the fish ladder and on top of the dam and would be used to monitor fish movement. Fish captured upstream of the fish ladder would then be transported downstream of the dam to study if they use the fish ladder to return to their place of capture. Attractive flow versus the location of the ladder entrance would be studied to determine if these factors are affecting migrating native fish including YCT. This study would be conducted over a period of at least two seasons.[61]

c. Stocking

The DLA (p. 4) proposes to partially mitigate project impacts to fish by providing funding to IDFG for a fish stocking program: "Annual funding to IDFG for fish stocking will start at $20,000/year and will be adjusted in future years according to an escalation formula to account for future inflation."

It is our understanding that IDFG has not had a YCT stocking program on the Teton River for decades. A search of historic stocking through 2000 for the Teton River seems to confirm that understanding.[62] The Conservation Groups request clarification on this proposed mitigation measure, including information that supports it would effectively mitigate project impacts on fish or that it is feasible.

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[61] *See* BLM, Letter to Kimberly Bose re: Study Report Addendum – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20210201-5011 (Jan. 29, 2021), pp. 8-9; IDFG, Letter to Kimberly D. Bose, Re: 2020 Study Report; Felt Hydroelectric Project FERC No. 5089, eLibrary no. 20200313-5092 (Mar. 13, 2020), p. 2.

[62] IDFG, Teton River Investigations Part II: Fish Population Surveys 25 Years After Teton Dam, Appendix A (Dec. 2004).

2. Recreation

The DLA describes low recreational use at the Project and proposes modest measures to protect this low-level use:

> Beginning with its initial development in the early 1900's, the Felt Hydroelectric Project has positively impacted recreation by offering one of the few public access routes into the rugged Teton Canyon. FRE began providing recreation facilities after the initial FERC licensing of the project in 1983 and, excepting a small exclusion area around the Felt Dam and intake, has made the entire project area accessible to the public for recreation use. Recreation measurements made in 2003 and again in 2017 – 2020 indicate that the Felt site continues to be used by the public for recreation but at relatively low levels of use. The FRE proposal to continue to provide and maintain the existing recreation facilities, including the access road, is likely to sustain recreation use at existing levels.[63]

The DLA does not demonstrate that the proposed measures are adequate to mitigate project impacts on recreation, or that the measures will be adequate to meet demand for recreation over the term of any new license. The DLA does not propose meaningful new recreational protection, mitigation, or enhancement measures. Instead, FRE's proposal appears limited to maintaining the status quo under which public access is substantially prevented by a barrier at the Project boundary on the canyon rim, which requires visitors to walk a half mile and roughly 500 vertical feet up or down the road to the river.

The Commission's recreation policy requires more than just maintaining existing recreational use:

> The Commission will evaluate the recreational resources of all projects under Federal license or applications therefor and seek, within its authority, *the ultimate development of these resources*, consistent with the needs of the area to the extent that such development is not inconsistent with the primary purpose of the project.[64]

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63 DLA, p. 55.

64 18 C.F.R. § 2.7 (emphasis added).

The Medicine Lodge RMP similarly calls for *enhancement* of recreational resources not just maintenance: "… BLM's multiple use management mandate directs [BLM] to maintain or *enhance* habitat for fish and wildlife and to provide recreation opportunities."[65]

We disagree with the DLA's assertion that the Project provides a recreational benefit by granting some access to the river. The Commission's recreation policy requires more than "any" benefit. As stated above, it calls for the "ultimate development" of recreational resources so long as it does not interfere with project operation.

The DLA does not show that existing access will be adequate to meet future demand. BLM has commented that recreation demand will be higher over the term of the new license:

> The Teton Recreation Coalition … is responding to public demand for more recreation opportunities along the Teton River by improving access and recreation opportunities at the old Teton Dam Site. In addition, the Spring Hollow boat access has recently been improved to facilitate recreational access to the Teton River. With these developments and the associated public interest of recreation use in the river corridor downstream of the Felt Hydroelectric project treat, it is anticipated that there will be heightened interest for recreation opportunities in the project area. Increased use of these downstream recreation sites will likely prompt greater public demand for sites such as the Felt Hydroelectric project reach. The BLM recommends that a range of access improvements be considered to address the growing recreation use along the river corridor.[66]

BLM and the National Park Service (NPS) have each recommended additional recreational study that addresses existing and future demand in the context of enhanced recreational access in the project vicinity. NPS has described the deficiencies in FRE's studies to date as follows:

> The recreation report describes the recreation data collected. This data relies on cameras and a log to capture recreation use. The recreation use includes fishing, boating, hunting,

65 Letter from to Kimberly Bose, Re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), p. 1.

66 BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), p. 3.

> and hiking. However, the data collected does not adequately address the recreation study needs. It counts current use without addressing visitor use perceptions, analyzing future recreation use, or assessing ways to improve recreation access. A recreation study on visitor use and access needs is essential to assess current and projected use and identify access needs and improvements to help inform the development of the Draft License Application and the Recreation Resource Management Plan, which will guide recreation management for the next 40 to 50-year license.[67]

BLM commented that the "very limited recreation study conducted thus far is inconsistent with" the Commission's regulations.[68]

In addition to rejecting requests for study and adoption of recreational mitigation measures from American Whitewater, BLM, and the NPS, the DLA also fails to include American Whitewater's comments on the Study Plan process in the table of comments and responses.[69] We describe deficiencies regarding specific recreational resources in more detail below.

a. <u>Portage</u>

The DLA is silent on American Whitewater's request[70] to remove the fencing that impedes portage of the project works and replace it with a formal portage trail. This low-cost and common-sense proposal was not studied or evaluated as a potential mitigation measure, or even expressly rejected by FRE. Information in the record indicates trail access for boaters is a limiting factor to recreational use, yet FRE did not develop or evaluate a proposal for a clear

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67 NPS, Letter to Kimberly D. Bose, Subject: Felt River Hydroelectric Project (FERC #5089). Teton River, ID, eLibrary no. 20200312-5015 (Mar. 11, 2020), p. 1. The NPS filed substantially the same comments in response to the Updated Study Report Addendum on January 7, 2021, *see* eLibrary no. 20210107-5041 (Jan. 6, 2021).

68 BLM, Letter to Kimberly Bose re: Study Report – Felt Hydroelectric Project (FERC No. 5089), eLibrary no. 20200316-5019 (Mar. 16, 2020), p. 3.

69 DLA, Appendix A.

70 *Id*. BLM also requested "exploring opportunities for…removing fencing," to which FRE merely replied "The licensing process will allow stakeholders to engage in the process of selecting alternatives." *Id*., p. 7.

portage route around the dam and other project works, that could also serve as a take-out trail and put-in trail from the Project road. This omission does not comply with the Commission's regulations.

b. Vehicular Road Access

In 2018, American Whitewater requested that FRE analyze and propose to remove the gate from the access road located on the canyon rim and allow and improve vehicular access to a proposed parking lot near the river.[71] It also requested that FRE analyze and propose to remove fencing that impedes portage of the Project and replace those impediments with a formalized portage trail. The Conservation Groups hereby reiterate these requests in response to the DLA.

Standard License Article 17 requires a licensee to provide recreational facilities and means to access those facilities:

> The Licensee shall construct, maintain, and operate, or shall arrange for the construction, maintenance, and operation of such reasonable recreational facilities, including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities, and utilities, giving consideration to the needs of the physically handicapped, and shall comply with such reasonable modifications of the project, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal or State agencies, after notice and opportunity for hearing.[72]

Despite this requirement, FRE rejected American Whitewater's proposal for vehicular access to the river based on a two-page contractor opinion that is not part of the study process or NEPA proceeding except by reference. There was no opportunity to offer comments, ask questions, collaborate on the scope, or otherwise meaningfully participate in that review. As

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[71] American Whitewater, Comments regarding the PAD and Request to Use the Traditional Licensing Process, eLibrary no. 20181015-5090 (Oct. 15, 2018) (Attachment 2), pp. 2-3.

[72] *Available at* https://www.ferc.gov/industries-data/hydropower/administration-and-compliance/standard-l-e-p-form-articles (last accessed Jul. 1, 2021).

such, this opinion is not informative for purposes of the Commission's environmental review and evaluation of mitigation measures.

The request for vehicular access to the river was made not only by American Whitewater, but also by BLM, which owns and manages the land on which the Project is located, and by the NPS.[73] We do not accept the summary conclusions of FRE nor their contractor that vehicular access should not be provided. The DLA does not include a single photograph of the road descending into the canyon, nor is there a transparent analysis of vehicular safety. It is not made clear that the right to gate the road belongs to FRE instead of BLM. The existing record is insufficient to support a future decision to foreclose vehicular access to the river in the new license.

We believe that based on an appropriate assessment of the road, vehicular access may be feasible, cost-effective, and in fact necessary for Project safety. Vehicular access would have significant recreational benefits in allowing paddlers and anglers of a greater diversity of physical capabilities and with a wider variety of craft to enjoy both affected sections of the exceptional Teton River.

Additionally, there are significant operational safety concerns regarding existing vehicular access. As the road safety opinion makes clear, the only way to reach the Project is inaccessible 8 months of the year, and that the steepness and sheer drop-off in one location poses a risk of death to vehicle passengers.[74] FRE does not address how that affects its ability to

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[73] BLM, Study Requests, eLibrary no. 20190212-5010 (Feb. 11, 2019); NPS, Study Requests, eLibrary no. 20190211-5010 (Feb. 8, 2019); NPS, Letter to Kimberly D. Bose re: Felt Hydroelectric Project (FERC #5089), Teton River, ID, Draft License Application (Jun. 29, 2021), eLibrary no. 20210629-5051.

[74] *See* DLA, Appendix B, p. 1:

> The river side of the roadway at the rockslide area is very shear [sic] and any vehicle that would slide off would be destroyed and death of passengers almost certain…

maintain the dam and facilities year-round, especially during the winter. What happens in the case of a fire, or a structural issue with the dam, a fish ladder failure, or an employee accident?[75] How is it safe for employees, contractors, emergency medical services, and regulators to travel the road but not the public? If the road is as bad as FRE claims, we question the appropriateness of operating a licensed hydropower project at the end of it.

c. **Parking Facilities**

American Whitewater requested a public parking lot be built near the river to serve as a river access area.[76] That request was not meaningfully acknowledged anywhere in the DLA, except in the independent consultant report included as Appendix B. The consultants state that there is room for a significant parking lot, but in the design they unilaterally envisioned there is no room to turn trailers around.[77] First, we note the conclusion that there is room for parking,

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> On our April 30th visit, there were snow drifts across the roadway and the roadway conditions were muddy and impassable with normal vehicles. We were provided a track vehicle to use and were able to complete the investigation. This situation suggests that if vehicular access is allowed, it can only be allowed from approximately May 30 to October 1st. Any earlier or later in the year would be recommended as unsafe.

[75] Standard License Article 22 requires a licensee to make all necessary preparations to prevent fires on project lands:

> The Licensee shall do everything reasonably within its power, and shall require its employees, contractors, and employees of contractors to do everything reasonably within their power, both independently and upon the request of officers of the agency concerned, to prevent, to make advance preparations for suppression of, and to suppress fires on the lands to be occupied or used under the license. The Licensee shall be liable for and shall pay the costs incurred by the United States in suppressing fires caused from the construction, operation, or maintenance of the project works or of the works appurtenant or accessory thereto under the license.

Available at https://www.ferc.gov/industries-data/hydropower/administration-and-compliance/standard-l-e-p-form-articles (last accessed Jul. 1, 2021).

[76] American Whitewater, Comments regarding the PAD and Request to Use the Traditional Licensing Process, eLibrary no. 20181015-5090 (Oct. 15, 2018) (Attachment 2), p. 3.

[77] DLA, Appendix B, p. 1: "The parking area is not sufficient to allow for vehicles with trailers to turn around. Trailers should not be allowed."

which is significant. Second, alternative designs could potentially allow for trailer turn-arounds.[78] Importantly, there may not be suitable trailer access into the river itself, so trailer access to the parking lot may be somewhat moot. Further exploring river access options in a collaborative manner through the FERC study process would allow for a meaningful consideration of access opportunities – while an out-of-the-blue consultant opinion does not.

3. Economic Feasibility

Under the Commission's regulations, the FLA must include a statement of costs and financing as Exhibit D.

Exhibit D in the DLA (p. 14) estimates the net present value of the Project at $14,000,000 based on several assumptions:

> A take over value was estimated based on fair market value. Fair market value was calculated assuming average annual generation of 33,100 MWH, capital and annual expenses as outlined in Tables 5 and 6, 30-year license term, current Idaho Power 20-yr levelized PURPA rate of $61.50/MWH, and a 6.5% rate of return. The net present value based on these figures is $14,000,000, which is provided as an estimate of the take over value.

We request that FRE provide additional information to support its assumption that average annual generation over the term of the new license would be 33,100 MWH. Table 3 in the DLA (p. 11), "*Flow probability for the Teton River approaching Felt Dam*," indicates a 50% annual flow probability of 309 cfs approaching Felt Dam. Powerhouse #2 can generate a maximum of 5.5 MW on a flow of 500 cfs (11 kw per 1 cfs). Assuming the entire flow is

[78] As stated in Appendix B, "In our discussion with the BLM there was mention of making a loop road by utilizing the old access trail. Much additional information including design level topo survey, geotechnical, geological investigations are needed to give an accurate opinion on the feasibility and cost to improve this trail into a vehicular passible roadway. This is beyond the scope of this study and we did not investigate it further." *Id.* We request additional research on this possibility. *See also* NPS, Letter to Kimberly D. Bose re: Felt Hydroelectric Project (FERC #5089), Teton River, ID, Draft License Application (Jun. 29, 2021), eLibrary no. 20210629-5051, p. 3: "The NPS recommends that the licensee assess the feasibility of this one-way loop road…"

available for generation it appears that the annual generation would be approximately 29,775 MWH as opposed to the stated estimate of 33,100 MWH. An accounting of actual annual generation would enable a more accurate evaluation of project economics.

Also, Table 5 in the DLA (p. 14), "*Capital cost estimate for Felt Project*," indicates a line item for "Powerhouse #1 repairs" in the amount of $600,000. Powerhouse #1 has been offline for 15 years due to floor damage. It is our understanding that Powerhouse #1, if made operational, would have flows for generation during a fraction of the year (June and July) then remain idle for the remaining months of the year. We request that FRE evaluate the economics of removing Powerhouse #1.

IV.
COMPREHENSIVE PLANS

Under FPA section 10(a)(2), the Commission must consider comprehensive plans developed by state and federal agencies in determining whether the Project will be best adapted to a comprehensive plan of development for the Teton River:

> (2) In order to ensure that the project adopted will be best adapted to the comprehensive plan described in paragraph (1), the Commission shall consider each of the following:
>
> (A) The extent to which the project is consistent with a comprehensive plan (where one exists) for improving, developing, or conserving a waterway or waterways affected by the project that is prepared by--
>
> (i) an agency established pursuant to Federal law that has the authority to prepare such a plan; or
>
> (ii) the State in which the facility is or will be located.[79]

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[79] 16 U.S.C. § 803(a)(2). FERC has adopted additional guidance regarding comprehensive plans it will consider under FPA section 10(a)(2):

> On April 27, 1988, the Commission issued Order No. 481-A, revising Order No. 481, issued October 26, 1987, establishing that the Commission will accord FPA section 10(a)(2)(A) comprehensive plan status to any Federal or state plan that:

A. Medicine Lodge Resource Management Plan

BLM adopted the Medicine Lodge RMP in 1985. That plan describes how the Medicine Lodge Resource Area is to be managed to protect various resources and uses, including water and recreation, as described below. It is included on the list of Comprehensive Plans maintained by the Commission.[80] Accordingly, Conservation Groups request that the FLA address how FRE's proposal will meet each of the resource objectives described below.

The Medicine Lodge RMP (p. 29) directs that water quality and riparian resources will be maintained or improved:

> Water quality will be maintained or improved in accordance with State and Federal standards, including consultation with state agencies on proposed projects that may significantly affect water quality. [¶] Management activities in riparian zones will be designed to maintain, or, where possible, improve riparian conditions.

The Medicine Lodge RMP (p. 30) directs the lands should be managed to provide recreational opportunities:

> A broad range of outdoor recreation opportunities will continue to be provided for all segments of the public, commensurate with demand. Trails and other means for public access will continue to be maintained and developed where necessary to enhance recreation opportunities and allow public use. … [P] Recreation resources will continue to be evaluated on a case-by-case basis as part of project level planning. Such evaluation will consider the significance of the proposed project and the sensitivity of recreation resources in the affected area. Stipulations will be attached as appropriate to assure compatibility of projects with recreation management objectives.

With regard to visual resources, the plan (p. 30) provides the following:

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1. Is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
2. Specifies the standards, the data, and the methodology used; and
3. Is filed with the Secretary of the Commission.

FERC, Comprehensive Planning, *available at* https://ferc.gov/licensing (last accessed Jul. 1, 2021).

[80] FERC, "List of Comprehensive Plans," https://cms.ferc.gov/media/list-comprehensive-plans (Apr. 6, 2021) (last accessed Jul. 1, 2021).

> Visual Resources will continue to be evaluated as part of activity and project planning. Such evaluation will consider the significance of the proposed project and the visual sensitivity of the affected area. Stipulations will be attached as appropriate to maintain existing visual resource management classes.

The plan (p. 33) provides for the consideration of cultural resources, and consultation as appropriate. It also provides for the construction and maintenance of roads *and trails* consistent with resource management objectives:

> Road and trail construction and maintenance will continue to be conducted in support of resource management objectives. … [¶] Specific road and trail construction standards will be determined based on consideration of the following criteria:
>
> - resource management needs;
> - user safety;
> - impacts to environmental values, including but not limited to wildlife and fisheries habitat, soil stability, recreation, and scenery; and
> - construction and maintenance costs.

The DLA does not adequately explain how the proposed licensing measures will comply with or contribute to these objectives over the term of any new license.

B. Request to Accept IDFG's Fisheries Management Plan 2019-2024 as a Comprehensive Plan.

As stated in Section IV, *supra*, under FPA section 10(a)(2) the Commission is required to consider the extent to which a new license is consistent with a comprehensive plan for improving, developing, or conserving a waterway affected by a project. The Conservation Groups request that the Commission add IDFG's *Fisheries Management Plan 2019-2024* (June 2019)[81] (Fisheries Management Plan) to the list of comprehensive plans for the state of Idaho.

The Fisheries Management Plan is relevant to this relicensing because it includes the guiding policy goals, objectives, and future direction for the riverine/riparian habitats in the

81 *Available at* https://idfg.idaho.gov/sites/default/files/2019-2024-idaho-fisheries-management-plan-original.pdf (last accessed Jul. 1, 2021).

Teton River watershed. The Commission lists the Fisheries Management Plan's predecessor from 2013 in its list of Comprehensive Plans.[82]

The Fisheries Management Plan meets the criteria listed in under Section 10(a)(2) (*see* footnote 79, *supra*), just as its predecessor did. IDFG has jurisdiction; the methods, standards, and data are clear; and the Conservation Groups are concurrently filing an electronic copy of the Fisheries Management Plan concurrently with the Secretary of the Commission in Docket No. ZZ09-5-000.

C. **Request to Accept FWS's Strategic Habitat Conservation in Idaho: Landscape Conservation Strategy as a Comprehensive Plan.**

The Conservation Groups also request that the commission accept FWS's *Strategic Habitat Conservation in Idaho: Landscape Conservation Strategy* (2016) (Strategic Habitat Conservation Plan)[83] to the list of comprehensive plans for the state of Idaho.

The Strategic Habitat Conservation Plan is relevant to this relicensing because it includes a comprehensive assessment of priority species in Middle Rockies landscapes affected by Felt Dam. *Id*. at 7, 17-25.

The Strategic Habitat Conservation Plan meets the criteria under Section 10(a)(2) (*see* footnote 79, *supra*). The FWS has responsibility for managing YCT and developed the Strategic Habitat Conservation Plan. The Strategic Habitat Conservation Plan includes a comprehensive study of measures and strategies necessary to protect riverine/riparian habitat in the Teton River

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[82] *See* FERC, "List of Comprehensive Plans," https://cms.ferc.gov/media/list-comprehensive-plans (Apr. 6, 2021) (last accessed Jul. 1, 2021): "Idaho Department of Fish and Game. 2013. Fisheries management plan, 2013-2018. Boise, Idaho. 2013."

[83] *Available at* https://www.fws.gov/idaho/documents/SHC/IFWOstrategicframework_20April2016compressed.pdf (last accessed Jul. 1, 2021).

watershed. The Strategic Habitat Conservation Plan articulates the standards applied and documents the scientific methodology used. *Id*. at 3-5. The Conservation Groups are filing an electronic copy of Strategic Habitat Conservation concurrently with the Secretary of the Commission in Docket No. ZZ09-5-000.

V.
CONCLUSION

We thank FRE and the Commission for considering these comments.

Dated: July 2, 2021

Respectfully submitted,

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DECLARATION OF SERVICE

Fall River Rural Electric Cooperative, Inc.'s Felt Hydroelectric Project (P-5089)

I, Emma Roos-Collins, declare that I today served the attached "American Rivers et al.'s Comments on the Draft License Application for the Felt Hydroelectric Project (P-5089)" by electronic mail, or by first-class mail if no e-mail address is provided, to each person on the official service list compiled by the Secretary in this proceeding.

Dated: July 2, 2021

By: Emma Roos Collins

____

Emma Roos-Collins
Paralegal/Firm Administrator
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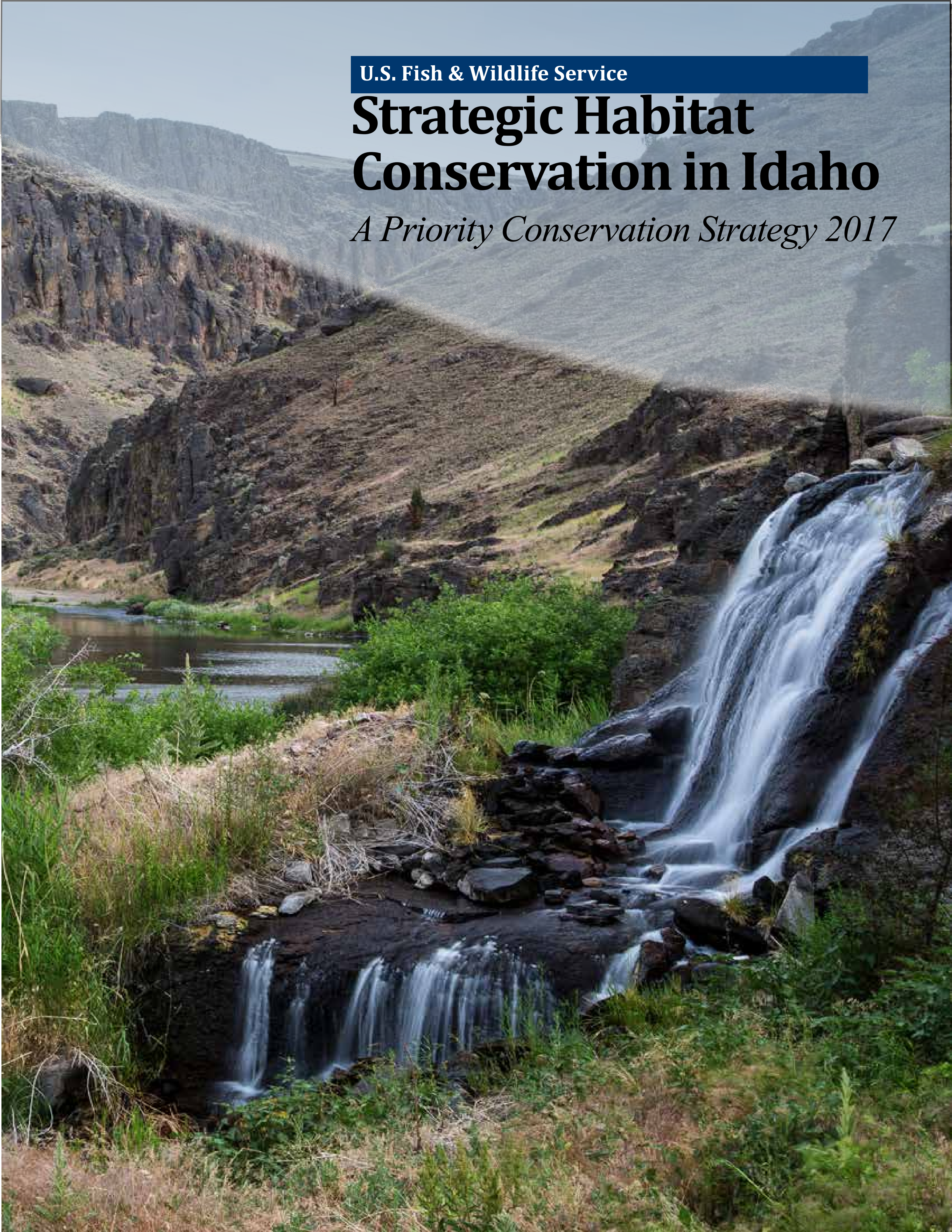
Attachment 1

U.S. Fish & Wildlife Service

Strategic Habitat Conservation in Idaho

A Priority Conservation Strategy 2017



MacFarlane's four-o'clock © Mark Lowry / BLM

Cover Photo: Owyhee River © BLM

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Greater sage-grouse © Steve Fairbairn / FWS

Executive Summary

In recent years, the Fish and Wildlife Service has emphasized a need to focus our efforts at larger geographic scales if we are to more successfully address conservation challenges such as changing land use and climate. Placing greater effort in areas of strategic conservation importance will better ensure that our investments are meaningful and long lasting. The agency has also emphasized a need to better employ a science-based adaptive approach to ensure that we are effective in meeting our conservation objectives. The Idaho Fish and Wildlife Office (IFWO) used this guidance to identify four Priority Conservation Areas in the State of Idaho where there are compelling conservation interests for Federal Trust resources, the habitats in which they dwell, and associated natural resources that are valued by the public. The IFWO identified 39 Priority Species that utilize habitats within these areas and serve as habitat indicators, icons, keystone, or umbrella species. Lastly, we drafted Conservation Strategies that provide stated goals, objectives, and Conservation Actions that focus on high profile targets (habitats or Priority Species) within each Priority Conservation Area. These Conservation Strategies address important conservation activities, and are designed to improve habitat health and ecological integrity for all native species that rely on its associated Priority Conservation Area. This version of the IFWO Statewide Conservation Strategy incorporates input solicited from our partners, in recognition of the fact that large-scale efforts will require willing collaborations between multiple partners, including Idaho State, Federal, and Tribal agencies, as well as private conservation and user groups, as we shift to strategy implementation.

1. Introduction

1.1 Background and Need

The State of Idaho is comprised of some of the largest undeveloped and wild lands in the lower 48 states, containing a diverse range of habitats including sagebrush ecosystems, montane forests, free-flowing wilderness rivers, desert canyons, mountain lakes, and alpine summits. It is home to iconic species like wolves, grizzly bears, and wolverines, as well as lesser known wildlife, plant, and fish species that are found only in Idaho. Runs of salmon and steelhead trout still return from the Pacific Ocean to Idaho, where they spawn in the remote Salmon and Clearwater River basins. Idahoans are proud of their natural resources, and many people journey to this state to experience its scenery and wildlife.

Idaho is a large state at nearly 84,000 square miles and supports about 1.6 million residents. However, the human population is rapidly growing, putting increased demands on limited natural resources. The majority of Idaho is publicly owned and relatively undeveloped, offering a multitude of recreational opportunities. Much of Idaho has been converted to agriculture, which is a major component of the state's economy, and supports other land uses such as livestock grazing, timber harvest, and mining. Historically, conservation of natural resources has been challenged by multiple land use impacts and legacy effects remain. Today, Idaho's resources are confronted by a suite of new challenges such as energy development, aquifer depletion, invasive species, changing frequency and intensity of wildfires, and urban development. Additionally, climate change threatens to exacerbate many of these issues. Conservation efforts conducted by the U.S. Fish and Wildlife Service (Service) in Idaho, with our many partners, have resulted in important successes, but the growing human population, along with changes in land use and other threats, requires a more strategic approach in how we plan and implement conservation. In order to more effectively guide our conservation efforts into the future, the Idaho Fish and Wildlife Office (IFWO) of the Service has produced the following Priority Conservation Strategy (Strategy).

The Service is a Federal agency with specific **trust resource**[1] responsibilities, which are integrally tied to the habitats upon which trust species depend. In 2014, the IFWO completed a Comprehensive Conservation Framework[2], which laid the foundation for developing a statewide conservation strategy that would guide our efforts in the coming years. The purpose of this Strategy is to ensure the resource conservation work the IFWO engages in is strategically coordinated with our partners to provide the greatest long-term conservation value. We recognize that the Service's limited resources are one small component of the conservation work occurring in Idaho, yet we also acknowledge that as a leading conservation agency we influence the conservation activities occurring in this state. To ensure the IFWO will be engaging in future conservation work consistent with our mission and trust responsibilities, we felt that a necessary first step in this process was for us to identify our priorities in which our future resource work would focus.

Sawtooth Mountains © FWS

NOTE: *Superscripts denote Endnotes on p.47. Glossary words in the main text are* **bold blue underlined** *type. Definitions can be found on p.48 of this document. Hover your cursor over glossary words or superscript numbers for a link to the Glossary and Endnote pages.*

1.2 Geographic Approach

Recently the Service has stressed the need to focus on large-scale efforts to better conserve sustainable biological communities in the face of existing and expanding threats. This approach will require the Service to identify priority areas that carry the greatest potential for conservation gains and support collaborative efforts to those ends. While this more focused effort may reduce, but not eliminate, our conservation efforts in areas outside of the selected **Priority Conservation Areas**, it will result in more effective and longer lasting conservation gains relative to the resources committed.

This approach requires strong partnerships with land and wildlife managers from state, Federal, and Tribal agencies, as well as local governments, private landowners, non-governmental organizations (NGOs), and other stakeholders, to ensure shared conservation goals and objectives are achieved.

1.3 Strategic Habitat Conservation Approach

The Service strives to use the best available science in its planning and decision-making processes and as a tool to measure conservation success. To this end, the IFWO will apply the Service's Strategic Habitat Conservation (SHC)[3] approach to implement a science-based, adaptive process to our conservation efforts. The SHC process will employ all of the IFWO's tools to conserve and protect healthy and sustainable ecological processes within selected areas. As implemented by the Service, SHC will also support a monitoring component that allows biologists and managers to measure success, detect shortcomings, and allow for modifications as the SHC process continues or new projects are planned and initiated to ensure the management efforts are resulting in the identified conservation goals.

A potentially effective approach currently being studied for its use in SHC is that of adoption of "surrogate species." Surrogate species are species whose qualities make them good proxies for habitat health (**ecological integrity**), serving as indicators (**indicator species**) of the habitat and other species that rely on those habitats. Surrogate species may also be selected based on their effectiveness as habitat icons (**iconic species**) or "flagships," their supporting role in the biological community (**keystone species**), or their value in providing conservation benefits for other species (**umbrella species**). Identifying and managing surrogate species may be effective because it is not feasible or efficient to carry out conservation actions on a species-by-species basis. Selecting and monitoring appropriate surrogates can assist managers to assess the effectiveness of their management actions and greatly reduce the number of variables to be monitored, thereby reducing monitoring efforts and costs. Good surrogates may not only serve as indicators of their habitat and biological community, but may also be used to educate and engage the public. Surrogate species are not specifically identified in this Strategy, but many of the **Priority Species** identified in this plan possess strong surrogate characteristics. The IFWO acknowledges that no single species can serve as a proxy for all others with which it shares habitat or resources, but many can be used as responsive and visible indicators of habitat health and be used as one metric in achieving shared conservation objectives.

In May of 2014, the IFWO completed a Comprehensive Conservation Framework[2] outlining a path to identify Priority Conservation Areas that would serve as focal areas for our conservation efforts. This Strategy describes the outcome of that process and positions the IFWO for the next steps of collaborating with partners and implementing strategic conservation actions in these selected Priority Conservation Areas. This Strategy is not final, but rather a living document that will be updated over time with the participation of partnering agencies, organizations, Tribes, and individuals.

Focusing on selected Priority Conservation Areas will require shifting more of IFWO's resources from a diffuse statewide approach to a more geographically-focused approach, bringing our efforts to bear on areas with potential for large, long-lasting conservation gains. This will require IFWO staff to spend more time on partnering, project implementation, and monitoring within those areas, and less time on work with lower conservation value. This does not mean we will abandon efforts outside of Priority Conservation Areas since Service mandates such as listed species, Federal projects, and critical partnering opportunities occur throughout the state. However, IFWO staff and managers will need to assess the conservation value of all projects and make decisions that direct office resources to those work items of strategic value, while reducing our efforts in areas of little conservation gain, both within and outside of the selected Priority Conservation Areas.

The successful implementation of any large-scale strategy will rely heavily on the willing participation of our partners, along with an active and concerted community outreach effort. Most importantly, a long-term adaptive approach will require dedicated commitment and support from the Service at all levels of our organization: state, regional, and national.

2. Methods

2.1 IFWO All-Staff Engagement

Developing a statewide conservation strategy required engagement with all IFWO staff. To support this, the IFWO conducted three all-staff workshops held in 2014 and 2015. Topics addressed in these workshops included identifying: 1) statewide conservation goals and objectives, 2) Priority Species, and 3) Priority Conservation Areas. Development of these three planning components was based on the collective expertise of IFWO biologists, managers, and support staff from the three offices located in Boise, Chubbuck, and Spokane. This staff-collaborative approach helped ensure that expertise from all programs of the IFWO Ecological Services would be represented, would include local biological expertise from throughout the state, and that staff would develop a level of ownership in the process and outcomes of a final Strategy that would guide future work. Each workshop was supported by working groups made up of IFWO staff and geographic information system (GIS) experts that refined and standardized the Strategy components.

2.2 Identifying Goals and Objectives

Staff from the IFWO gathered for two days to develop general goal and objective statements that would later help guide the development of more specific **Conservation Strategies**. These goals and objectives were written to address conservation needs at different scales, both at the ecosystem- and species-level. In broad terms, the objectives sought to: 1) protect or restore habitats or populations of sufficient sizes to ensure their viability and resilience, 2) build connectivity (habitat and genetic) into the geographic design; 3) address habitat- and species-specific threats within selected priority areas, and 4) ensure development of monitoring efforts sufficient to measure results and adjust management as needed. Specific goals and objectives are further discussed under Conservation Strategies (section 2.5) below.

2.3 Selecting Priority Conservation Areas

Identification of potential Priority Conservation Areas was done by teams made up of IFWO staff (**Ecoregion Teams**) with expertise in each of seven Idaho ecoregions[4]. No specific constraints were placed on the geographic design, but they typically were based on: 1) major drainage systems or mountain ranges, 2) ranges of high profile species, 3) proximity to wilderness or other protected areas, and 4) major conservation initiatives or active partnering efforts. After the initial identification of potential Priority Conservation Areas, Ecoregion Team members used the previously developed goals and objectives as guidelines to rank these areas within each ecoregion. Many of the characteristics used in the design and ranking of these areas (e.g., functional habitat scale for ecosystem integrity, connectivity, habitat complexity, number of listed or Priority Species, perceived resiliency, proximity to other functional habitats) often lack quantitative values that lend themselves to objective decision-making. Hence, the delineation of geographic boundaries was subjective and left up to each Team's best professional judgment. Each of the Ecoregion Teams identified and ranked two to 10 identified areas within their ecoregion. These ranked areas were then provided to IFWO leadership, along with notations on other unique characteristics to ensure these areas with the highest and/or unique conservation value were considered.

The final Priority Conservation Areas were designated by IFWO leadership. Their final design was based on multiple factors including the rankings and rationales provided by the Ecoregion Teams, consideration of ecological integrity across ecoregion boundaries as well as state or country borders, and high profile partnerships or initiatives. Upon selection of the Priority Conservation Areas, Ecoregion Teams were replaced with **Conservation Teams** made up of IFWO staff members with habitat and/or species expertise applicable to the selected Priority Conservation Areas.

2.4 Selecting Priority Species

The initial list of potential priority species drafted by IFWO staff drew heavily from lists of protected, sensitive, or indicator species previously developed by other state and Federal agencies as well as associated working groups and NGOs[5]. While the IFWO considered priority, sensitive, or focal species identified by other agencies or organizations, the Service's authorities lie with Federal Trust species. Federal Trust species include migratory birds, threatened and endangered species (Endangered Species Act (Act)), inter-jurisdictional fish, bald and golden eagles, and marine mammals. Numerous native species are not regarded as Federal Trust resources. However, the Service's SHC approach emphasized using species that serve as good habitat indicators and preferably with a substantial level of public appeal, serving as icons or "flagships" for the respective habitat. Many of the identified Priority Species in this Strategy are not Federal Trust resources and their inclusion is based on their value as habitat indicators, icons, keystone components, or umbrella species of/for their community (see 1.3 above). Species not identified as Federal Trust resources are the responsibility of the states, and using state-managed species identified as Priority Species as metrics to measure management effectiveness or as public outreach tools will be coordinated with our state partners.

2.5 Conservation Strategies

Conservation Teams developed a number of strategies designed to provide guidance for the conservation of species or habitats (targets) with high profile conservation needs within their Priority Conservation Areas. These strategies are comprised of the goals and objectives developed by IFWO staff, tailored to each specific area target, as well as a list of **Conservation Actions** that address specific conservation needs of these targets. Many of the Conservation Actions are drawn directly from documents such as recovery plans, Wildlife Management Plans (Idaho Department of Fish and Game (IDFG)) and Federal land management plans. Most strategies include elements that consider projected climate change in an effort to ensure long-term success of the actions being carried out. Lastly, since multi-agency partnership are a critical component to the success of these strategies, many of the actions include collaborative review and design of pending land use plans being developed by partnering agencies.

2.6 Partner Review Process

After completing the draft Strategy, the IFWO submitted the draft to selected potential partners for their review and comment. Each of the Conservation Teams identified partners they regarded as critical to the planning and implementation process within their Priority Conservation Area, such as state and Federal natural resource management agencies, Tribes, and NGOs. This process allowed us to assess and incorporate the resource interests of those parties in order to help unify our conservation objectives. The IFWO requested and considered partner input on geographic design, selection of Priority Species, and adoption or modification of Conservation Actions. Partner recommendations were reviewed by the Conservation Teams and IFWO leadership, and adopted recommendations have been included in this version of the Strategy.

Whitebark pine © USFWS

3. Results

Priority Species and Conservation Strategies described here are regarded as working drafts which provide a level of flexibility as the IFWO engages partners and refines strategies. Hence, additional species (not identified in this Strategy) may be considered or dropped from consideration as our strategies are merged with those of our partners in these Priority Conservation Areas. Similarly, Conservation Strategies and Conservation Actions may be modified or their timelines adjusted based on current or planned priorities of our partners.

3.1 Priority Conservation Areas

Of 28 potential conservation areas initially identified by the Ecoregion Teams, four were designated and/or designed in the final selection. Three of these were based on the originally identified areas proposed by IFWO staff (Blue Mountains, Northern Basin & Range, and Northern Rockies), while the fourth was a composite of multiple geographic areas identified by the Middle Rockies and Snake River Plain Ecoregion Teams. The Middle Rockies Priority Conservation Area, includes key sagebrush ecosystems, important watersheds critical to anadromous and associated species, and montane habitats regarded as important corridors to the greater Rocky Mountain ecosystem (Figure 1). These Priority Conservation Areas account for an estimated 32% of the State of Idaho, with the Blue Mountains, Middle Rockies, Owyhee Uplands, and Selkirk Cabinet-Yaak areas comprising

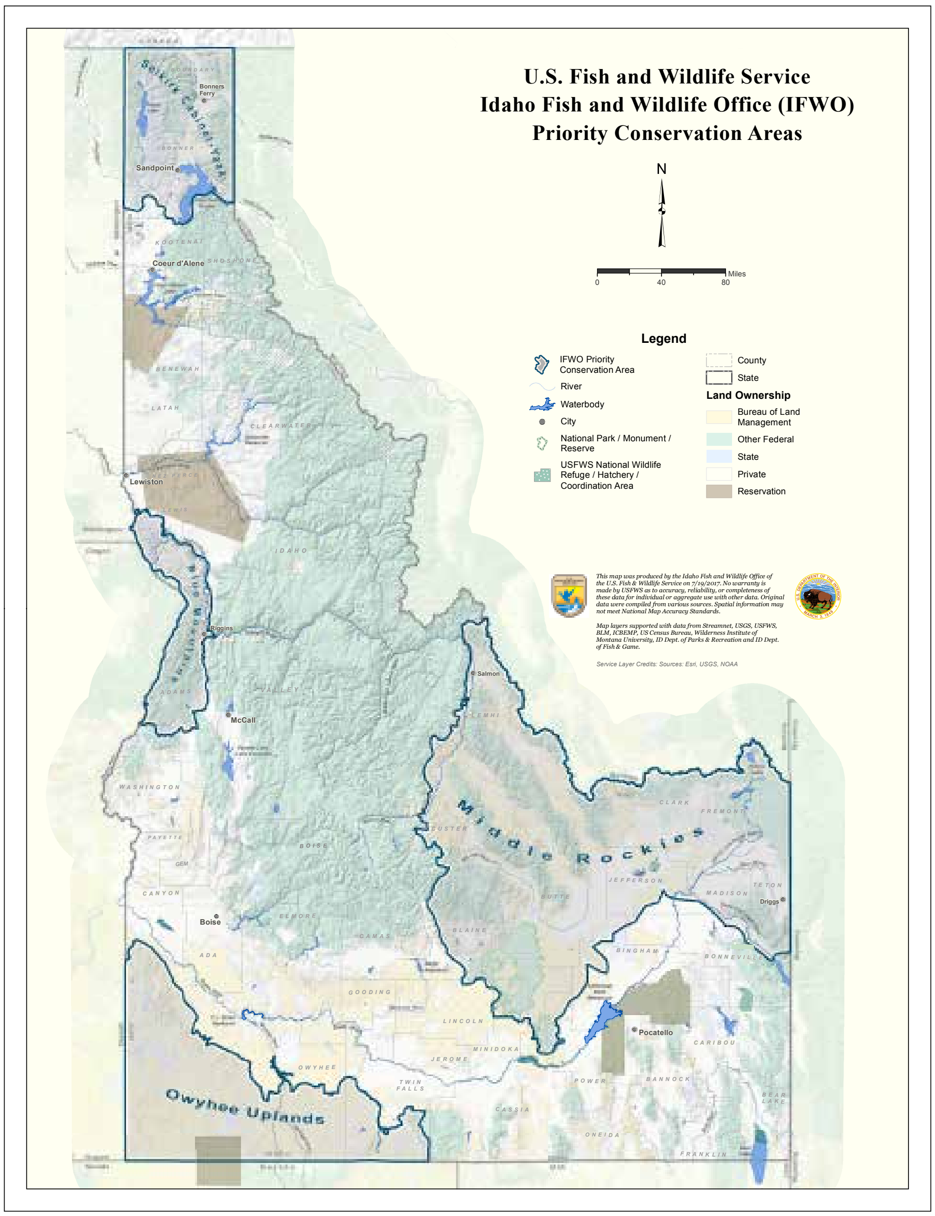

Figure 1. The state of Idaho illustrating the four Priority Conservation Areas identified by the IFWO.

an estimated 1.9%, 18.6%, 8.2%, and 3.3% respectively. Partner recommendations led to changes in the geographic boundary of the Middle Rockies Priority Conservation Area as well as a Priority Species associated with that area (yellow-billed cuckoo). The designation of a Palouse Prairie habitat strategy was also considered for the Blue Mountains Priority Conservation Area, but was ultimately not adopted in this iteration of the Strategy.

All four Priority Conservation Areas occur along state and/or international borders, requiring that inter-state and international coordination will be necessary to achieve the highest levels of habitat integrity and conservation.

3.2 Priority Species

Thirty-nine Priority Species were ultimately identified based on the priorities of the IFWO Conservation Teams along with recommendations of partners (Table 1). No species is shared by all four Priority Conservation Areas, however widespread aquatic species, such as bull trout, cutthroat trout[6], and the American beaver were identified in three of the four. Shared species also included some sagebrush obligates (greater sage-grouse, pygmy rabbit, sage thrasher, and sagebrush sparrow) in Middle Rockies and Owyhee Uplands Priority Conservation Areas. Grizzly bear were identified as a priority in both the Middle Rockies and Selkirk Cabinet-Yaak Priority Conservation Areas. Rocky Mountain bighorn sheep were adopted for inclusion in both the Blue Mountains and Middle Rockies Priority Conservation Areas, based partially on recommendations of IDFG and Tribal resource managers, with connectivity for this subspecies across central Idaho being an important consideration.

Thirteen of the Priority Species identified are federally protected under the Act or are candidates for listing. Two other species were recently removed from candidate or other listed status, while the single Idaho candidate for listing (whitebark pine) was identified as a Priority Species by two of the Conservation Teams. Other Federal Trust species include migratory birds (11 species, including bald and golden eagles), and inter-jurisdictional fish (eight species/subspecies). Each of the Conservation Strategies (Appendices I-IV) list those Priority Species that will be specifically addressed or benefited by respective **Conservation Actions**.

In addition to the federally listed species identified as Priority Species, the IFWO made an effort to include species with value as habitat indicators, habitat icons or flagships, or that provide keystone roles in the ecosystem. At least two of the species identified, American beaver and aspen, were identified as keystones because both provide habitat for numerous other species and can affect factors such as local climate and hydrologic processes. As emphasized throughout this document, use of any non-Trust species as a metric of habitat health or to promote public engagement will require buy-in and support by our state and other partners.

While the IFWO did consider, and in some cases adopted, less-common and/or endemic species (e.g., IDFG Species of Greatest Conservation Need (SGCNs)), the criteria used for identifying SGCNs differ from criteria used by the IFWO in selecting Priority Species (see section 1.3). In addition, many SGCNs lacked sufficient information (e.g., conservation needs) upon which to base appropriate Conservation Actions, and/or their distribution and abundance were insufficiently known for them to be used as a suitable indicator species at larger geographic scales. As previously discussed, the IFWO Priority Species were predominantly selected as habitat indicators or for possessing qualities as a keystone, umbrella, or iconic species for the habitats they inhabit, and whose management would benefit rarer species such as certain SGCNs. As the IFWO and its partners learn more about these lesser-known species, they may be incorporated into future, revised Strategies, but for the purposes of this version, only species with known distributions and conservation needs were adopted as Priority Species.

3.3 Conservation Strategies

Each Conservation Team identified three to four individual Conservation Strategies designed to address the priority conservation targets within their Priority Conservation Area (provided in Appendices I-IV). Each Conservation Strategy includes goals and objectives, specific to each Priority Conservation Area, along with corresponding Conservation Actions that address the most pertinent objectives or specific threats. Actions specific to each set of **Conservation Objectives** are referenced numerically at the end of each goal and Conservation Objective statement, and are listed at the end of each strategy. For the purposes of this document, the strategies provided in the appendices have been restricted to goals, objectives, and actions, keeping them general and brief. These strategies and actions will be refined through continuing collaboration with our conservation partners.

Table 1. Priority species identified for each of four IFWO Priority Conservation Areas. See appendices for scientific names of all Priority Species.

Blue Mountains	Middle Rockies	Owyhee Uplands	Selkirk Cabinet-Yaak
Bighorn Sheep	American Beaver	American Beaver	American Beaver
Bull Trout	Aspen	Aspen	Bull Trout
Flammulated Owl	Bighorn Sheep	Columbia Spotted Frog	Canada Lynx
MacFarlane’s Four-o’clock	Bull Trout	Greater Sage-grouse	Fisher
Mountain Quail	Chinook Salmon	Interior Redband Trout	Grizzly Bear
Northern Goshawk	Greater Sage-grouse	Pygmy Rabbit	Interior Redband Trout
Northern Idaho Ground Squirrel	Grizzly Bear	Sage Thrasher	Kootenai White Sturgeon[7]
Pacific Lamprey	Little Brown Bat	Sagebrush Sparrow	Little Brown Bat
Rocky Mountain Tailed Frog	Pygmy Rabbit	Slickspot Peppergrass	Northern Leopard Frog
Spalding’s Catchfly	Rocky Mountain Tailed Frog		Western Bumble Bee
Westslope Cutthroat Trout	Sage Thrasher		Westslope Cutthroat Trout
White Sturgeon[7]	Sagebrush Sparrow		Whitebark Pine
White-headed Woodpecker	Steelhead		Willow Flycatcher
Willow Flycatcher	Townsend’s Big-eared Bat		Woodland Caribou
	Trumpeter Swan		
	Western Pearlshell		
	Westslope Cutthroat Trout		
	Whitebark Pine		
	White-faced Ibis		
	Yellow-billed Cuckoo		
	Yellowstone Cutthroat Trout		

4. Continuing Process

The four Conservation Teams have identified a list of strategies and actions intended to advance on-the-ground conservation in the State of Idaho. A number of the strategies and actions are already underway or being actively planned (e.g., IFWO Partners for Fish and Wildlife Program, statewide sage-grouse initiatives), while others have willing partners but are awaiting support and engagement to move them forward. Many of the strategies and/or actions outlined in this document target the same habitats and species as the Idaho State Wildlife Action Plan (SWAP[8]) and propose many of the same general management actions to achieve conservation of these resources. These commonalities will provide for significant opportunities to pursue collaboratively prioritized conservation objectives.

The IFWO Strategy does not address all threats to all species. For example, emerging threats such as wind energy development and white-nose syndrome, and their effects on Idaho’s bat species, are not addressed or are restricted to monitoring actions. This Strategy focuses on long-standing threats to habitats and species, as well as established conservation solutions to those threats, and begins a prioritization framework. Addressing emerging and future threats will be part of the adaptive approach that will include multiple partners, as will the next iteration of identification and prioritization of Conservation Actions. Completion of this version of the Strategy positions the IFWO to help guide or provide a supporting role with other Idaho partners. As noted by IDFG in their 2015 State Wildlife Action Plan, ongoing collaboration will help ensure natural resource management agencies and organizations will achieve their conservation goals and objectives and the IFWO will actively engage with these managers to better assure our mutual successes. The IFWO’s Conservation Teams shall remain engaged in the SWAP and other collaborative processes to advance effective conservation in Idaho.

Appendices: Priority Conservation Area Strategies

The appendices include a brief description of the conservation strategies developed by each of the four Conservation Teams. Conservation Strategies are meant to provide a step-down outline of the most pressing conservation issues in which the Service is engaged within the identified Priority Conservation Areas. Maps of each of these areas are provided at the beginning of each appendix: Blue Mountains, Middle Rockies, Owyhee Uplands, and Selkirk Cabinet-Yaak. The list of Conservation Actions, located immediately following the strategy goals and supporting Conservation Objectives, do not contain great detail, but identify the primary needs or threats that will be necessary to address the stated objectives. Each Conservation Team will develop more detailed accounts to help guide the planning and implementation of these Conservation Strategies with partners.

Canada lynx © David Moskowitz

Appendix I: Blue Mountains Priority Conservation Area

The Blue Mountains Conservation Team identified three conservation targets and drafted Conservation Strategies to address them: 1) aquatic habitats that support native resident salmonids; 2) canyon grasslands of the Snake and Salmon River drainage systems; and 3) ponderosa pine woodlands. These targets include 14 IFWO Priority Species, four of which are federally listed. This area's western boundary contacts both Oregon and Washington States, serving as a habitat corridor from terrestrial habitats of the Rocky Mountains to the Cascades, and includes an important anadromous link to much of central Idaho (Figure 2). This conservation area contains or helps connect significant wilderness areas and their biota such as Seven Devils, Gospel Hump, Frank Church River of No Return, and the Eagle Cap (Oregon) wilderness areas.

Conservation Strategy 1: Secure and enhance native, resident salmonid populations and their habitats in the Blue Mountains Priority Conservation Area.

Priority Species: Bull Trout *(Salvelinus confluentus),* Westslope Cutthroat Trout *(Oncorhynchus clarkia lewisi),* Rocky Mountain Tailed Frog *(Ascaphus montanus),* White Sturgeon *(Acipenser transmontanus),* Pacific Lamprey *(Entosphenus tridentatus).*

Goal 1a: Ensure resilient, ecologically functioning aquatic habitats capable of supporting native species in the Blue Mountains Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional blocks of streams and rivers supporting aquatic Priority Species.

ii. Identify and restore aquatic habitats to ensure their use by aquatic Priority Species and that will promote connectivity within existing functional blocks of aquatic habitat.

iii. Identify and address threats to aquatic habitats and their surrounding terrestrial and riparian habitats to ensure aquatic integrity.

iv. Protect and restore all aquatic habitat types (lakes, rivers, streams) to ensure habitats for all life-history needs of aquatic Priority Species are available and connected.

Actions: 1, 2, 4, 5, 6, 7, 8 (see complete list of Actions below).

Goal 1b: Ensure abundant, diverse, and resilient populations of aquatic Priority Species within the habitats of the Blue Mountain Priority Conservation Area.

Conservation Objectives

i. Confirm Priority Species and identify appropriate indicator species as needed. Identify additional aquatic species that require special consideration as appropriate (e.g., federally listed species or other species identified by partners).

ii. Protect or restore native habitats that support key life history components of Priority Species.

iii. Identify and address threats to aquatic Priority Species and their habitats.

iv. Promote connectivity between important habitat patches for aquatic Priority Species.

v. Promote genetic diversity of Priority Species in the Blue Mountains.

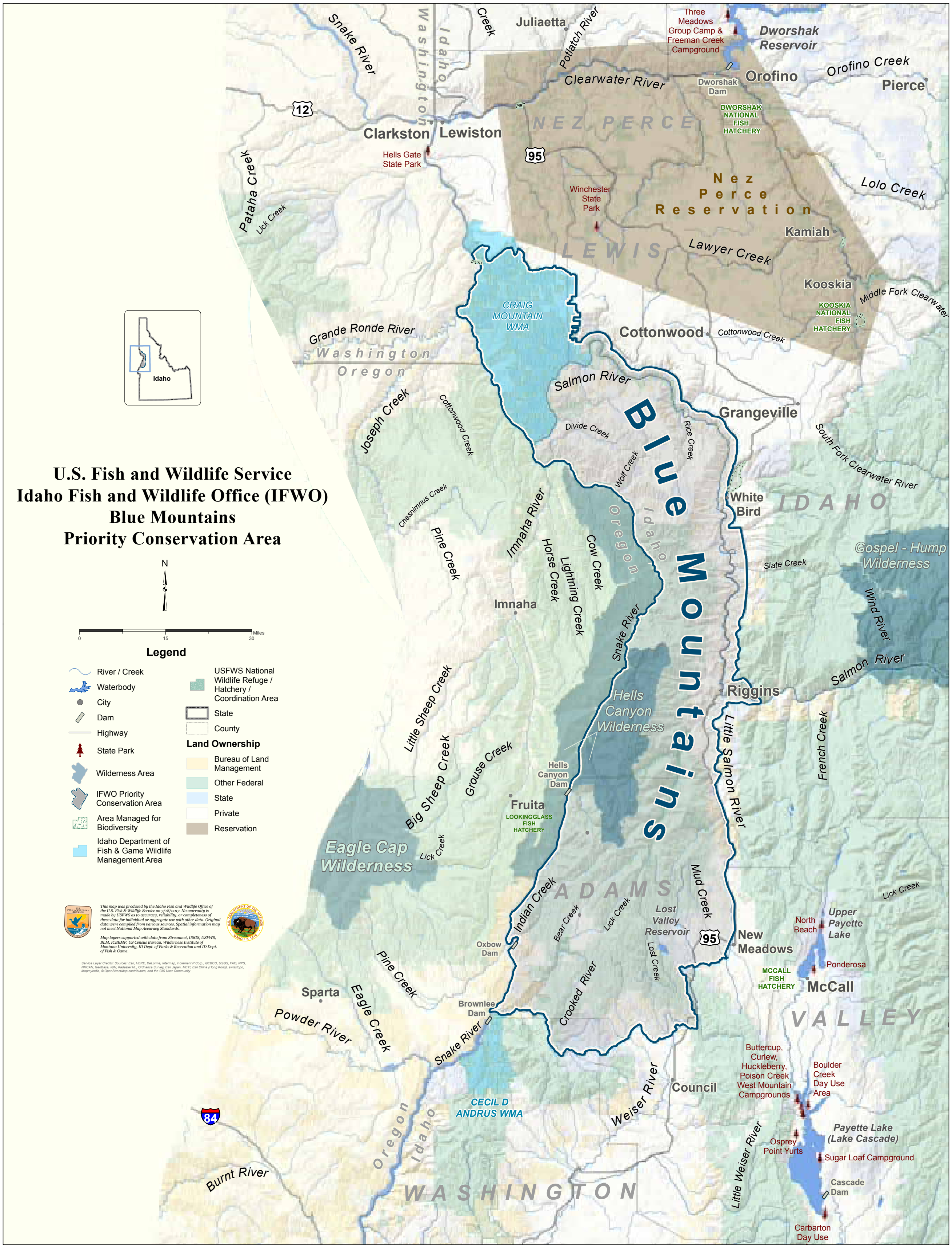

Figure 2. The Blue Mountains Priority Conservation Area covers an estimated 2.0% of the State of Idaho, contains diverse habitats and serves as a corridor for anadromous and terrestrial species between the coastal states and mountain interior.

vi. Protect unique native species associated with aquatic habitats of the Blue Mountains Priority Conservation Area.

Actions: 2, 3, 5, 6, 7 (see below).

Goal 1c: Ensure that aquatic habitats within the Blue Mountains Priority Conservation Area are biologically connected to adjacent habitats.

Conservation Objectives

i. Identify existing and potential aquatic corridors to existing functional blocks of aquatic habitats in the Salmon and Snake River drainages, and similar drainages in Oregon, that will provide connectivity to aquatic Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Blue Mountains Priority Conservation Area.

iii. With partners, plan restoration and/or mitigation efforts for aquatic habitats that connect adjacent areas or functional blocks of aquatic habitat.

Actions: 8 (see below).

Conservation Actions for Blue Mountains Conservation Strategy 1:

Action 1: Using climate and resiliency models assess predicted habitat suitability for bull trout and/or other native aquatic species and focus on suitable areas for Conservation Actions (Focal Drainages).

Action 2: Removal of passage barriers within Focal Drainages: a) Culvert replacement, b) fish ladder installation, c) fish screen installation, d) thermal barrier remediation (identified as primary threat and/or recovery action in USFWS 2010, 2015a, b)[9];

Action 3: Control harmful non-native fish species within Focal Drainages (identified in 2015 RUIP[9]);

Action 4: Restore or enhance anadromy, where appropriate, within Focal Drainages;

Action 5: Within Focal Drainages assess human water use in drainage and secure necessary in-stream flow sufficient for healthy trout populations and anadromy (identified in RUIP[9]);

Action 6: Reduce sedimentation to streams in Focal Drainages;

Action 7: Develop implementation and monitoring plan with partners for achieving selected objectives.

Action 8: Consider habitat conditions adjacent to Blue Mountains Priority Conservation Area and work with partners to promote connectivity of aquatic habitats where appropriate.

Conservation Strategy 2: Secure and enhance canyon grasslands in the Salmon and Snake River corridors.

Priority Species: MacFarlane's Four-o'clock *(Mirabilis macfarlanei)*, Spalding's Catchfly *(Silene spaldingi)*, Willow Flycatcher *(Empidonax traillii)*, Mountain Quail *(Oreortyx pictus)*, Rocky Mountain Bighorn Sheep *(Ovis canadensis canadensis)*.

Goal 2a: Ensure resilient, ecologically functioning canyon grassland habitats capable of supporting native species in the Blue Mountain Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional blocks of canyon grasslands and the Priority Species within them.

ii. Identify and restore impacted grassland habitats to ensure their use by Priority Species and promote connectivity to adjacent functional blocks of grassland habitat.

iii. Identify and address threats to canyon grassland habitats.

iv. Protect and restore adjacent habitats to provide connected mosaic of native habitats.

Actions: 1, 2, 3, 4, 5, 6, 7 (see complete list of Actions below).

Goal 2b: Ensure abundant, diverse, and resilient populations of native species within the targeted canyon grassland habitats.

Conservation Objectives

i. Confirm Priority Species and identify appropriate indicator species as needed. Identify additional canyon grassland species that require special consideration as appropriate (e.g., federally listed species, SGCNs, or other species identified by partners).

ii. Protect or restore native habitats that support key life history components of Priority Species.

iii. Identify and address threats to canyon grassland-inhabiting Priority Species within targeted habitats.

iv. Promote connectivity for Priority Species between important habitat patches of targeted canyon grasslands (Focal Grasslands; see Strategy below).

v. Promote genetic diversity of Priority Species in the targeted canyon grassland habitats.

vi. Protect native species (Priority, listed, SGCNs, etc.) associated with canyon grassland habitats of the Blue Mountains Priority Conservation Area.

Actions: 1, 2, 3, 4, 5, 7, 9, 10, 11, 12 (see below).

Goal 2c: Ensure that Priority Conservation Areas within and adjacent to Idaho are biologically connected.

Conservation Objectives

i. Identify existing and potential corridors between existing functional blocks of canyon grassland habitats within the Blue Mountains Ecoregion (Idaho, Oregon, and Washington).

ii. With partners, promote connectivity between important habitat patches throughout the Blue Mountains and adjacent areas.

iii. With partners, plan restoration and/or mitigation efforts for canyon grasslands and adjoining habitats that promote connectivity of Priority Species.

Actions: 1, 8 (see below).

Conservation Actions for Blue Mountains Conservation Strategy 2:

Action 1: Using climate and resiliency models and land condition data, assess predicted habitat changes in the canyon grasslands biome within the Blue Mountains Priority Conservation Area. Identify resilient canyon grassland habitat patches (Focal Grasslands) with partner participation (IDFG, Bureau of Land Management (BLM), and The Nature Conservancy (TNC).

Action 2: Develop integrated weed management plan with partners for identified invasive plants within Focal Grasslands (identified as Primary Threat in plant recovery plans[10] and IDFG[11]).

Action 3: Effectively manage livestock grazing within Focal Grasslands (identified in recovery plans[10] and IDFG[11]) and associated riparian habitats.

Action 4: Restore or enhance native vegetation communities (and supporting components) for the benefit of co-occurring plants and native animal species within Focal Grasslands and adjacent habitats (e.g., riparian).

Action 5: Control use of pesticides (herbicides, insecticides, fungicides) in Focal Grasslands and adjacent habitats as appropriate.

Action 6: Include Riparian and spring protection and restoration projects where they occur within Focal Grassland project areas.

Action 7: Develop implementation and monitoring plan with partners (IDFG, BLM, TNC, and Nez Perce Tribe and private parties as appropriate) for achieving selected objectives.

Action 8: Consider canyon grassland habitat conditions adjacent to Blue Mountains Priority Conservation Area and work with partners to promote connectivity where appropriate.

Action 9: Work with partners to minimize grazing conflicts between bighorn sheep and domestic sheep.

Action 10: Work with partners (internal and external) to increase public education on bighorn sheep, specific to disease transmission risk.

Action 11: Support research associated with bighorn sheep.

Action 12: Assist partners with augmentation and translocation of bighorn sheep.

Conservation Strategy 3: Secure and enhance ponderosa pine woodlands.

Priority Species: Northern Goshawk *(Accipiter gentilis)*, Northern Idaho Ground Squirrel *(NIDGS; Uroitellus brunneus)*, Flammulated Owl *(Ottus flammeus)*, White-headed Woodpecker *(Leuconotopicus albolarvatus)*.

Goal 3a: Ensure resilient, ecologically functioning ponderosa pine woodland habitats capable of supporting native species in the Blue Mountain Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional blocks of ponderosa pine woodlands and the Priority Species within them.

ii. Using projected climate and habitat models, identify future habitat areas and migration corridors for ponderosa pine forest within and adjacent to the Blue Mountain Priority Conservation Area.

iii. Identify and restore impacted ponderosa pine woodland habitats to ensure their use by Priority Species and promote connectivity to adjacent functional blocks of ponderosa pine woodland habitat.

iv. Identify and address threats to ponderosa pine woodland habitats.

v. Protect and restore adjacent habitats to provide connected mosaic of native habitats.

Actions: 1, 2, 3, 4, 5 (see complete list of Actions below).

Goal 3b: Ensure abundant, and resilient populations of native species within the targeted ponderosa pine woodland habitats.

Conservation Objectives

i. Confirm Priority Species and identify appropriate indicator species as needed. Identify additional ponderosa pine woodland species that require special consideration as appropriate (e.g., federally listed species, SGCNs, or other species identified by partners).

ii. Protect or restore native habitats that support key life history components of Priority Species.

iii. Identify and address threats to ponderosa pine woodland-inhabiting Priority Species within targeted habitats.

iv. Promote connectivity for Priority Species between important habitat patches of targeted ponderosa pine woodlands (Focal Woodlands; see Conservation Action below) for current and projected future range.

v. Promote genetic diversity of Priority Species in the targeted ponderosa pine woodland habitats.

vi. Protect unique native species (Priority, listed, SGCNs, etc.) associated with ponderosa pine woodland habitats of the Blue Mountains Priority Conservation Area.

Action: 1, 3, 4, 5 (see below).

Goal 3c: Ensure that Priority Conservation Areas within and adjacent to Idaho are biologically connected.

Conservation Objectives

i. Identify existing and potential corridors between existing functional blocks of ponderosa pine woodland habitats within Blue Mountain Ecoregion (Idaho, Oregon, and Washington). Identify areas with likely future climatic regimes, within or adjacent to areas where ponderosa pine is likely to thrive in the future (50-100 years).

ii. With partners, promote connectivity between important habitat patches throughout the Blue Mountains Ecoregion and adjacent Ecoregions.

iii. With partners, plan restoration and/or mitigation efforts for ponderosa pine woodlands and adjoining habitats that promote connectivity of Priority Species.

Actions: 1, 6, 7 (see below).

Conservation Actions for Blue Mountains Conservation Strategy 3:

Action 1: Using climate and resiliency models and land condition data, assess predicted habitat changes in the ponderosa pine woodland biome within the Blue Mountains Priority Conservation Area. Identify resilient ponderosa pine habitat patches (Focal Woodlands) with partner participation (IDFG, BLM, TNC). Identify sites supportive of ponderosa pine woodland habitat in the future (100-year) and plan for appropriate management of these areas.

Action 2: Develop integrated weed management plan with partners for identified invasive plants within ponderosa pine woodland habitat.

Action 3: Restore or enhance native vegetation communities (and supporting components) to historical conditions, including restoring a fire regime similar to conditions supportive of ponderosa pine woodland habitat (more frequent, low intensity fires), for the benefit of Priority Species and other co-occurring plants and native animal species.

Action 4: Utilize ESA candidate and recovery programs to support recovery of candidate and listed native species, and co-occurring native species, on private lands.

Action 5: Develop and implement focal species monitoring plans with partners (IDFG, Forest Service, and others as appropriate).

Action 6: Consider ponderosa pine woodland conditions adjacent to Blue Mountains Priority Conservation Area and work with partners to promote connectivity where appropriate.

Action 7: Work with partners across state borders to keep habitats connected and in good ecological condition, regardless of land ownership or jurisdiction.

Appendix II: Middle Rockies Priority Conservation Area

The Middle Rockies Priority Conservation Area represents the largest of the IFWO's identified conservation areas, covering an estimated 18.6% of the state, and supporting a number of diverse habitat types, including basalt desert scrub, alpine, anadromous river systems, and some of the largest areas of karst and pseudo-karst (volcanic) in the state (Figure 3). The Middle Rockies Conservation Team identified four Conservation Strategies for this area: 1) secure and enhance sagebrush ecosystems for the benefit of Priority Species, 2) secure and enhance wetland habitats, 3) enhancing the viability of forest ecosystems, and 4) securing and enhancing riverine/riparian habitats. These strategies identify 21 IFWO Priority Species, six of which are federally listed or candidates for listing. A highly complex region, the Middle Rockies Priority Conservation Area contains substantial areas of sagebrush ecosystem to the south and montane habitat corridors and anadromous streams and rivers to the north, and is recognized as an important corridor within the greater Rocky Mountain ecosystem. This Priority Conservation Area connects protected areas such as Yellowstone National Park, Boulder-White Clouds Wilderness Area and the Frank Church River of No Return Wilderness.

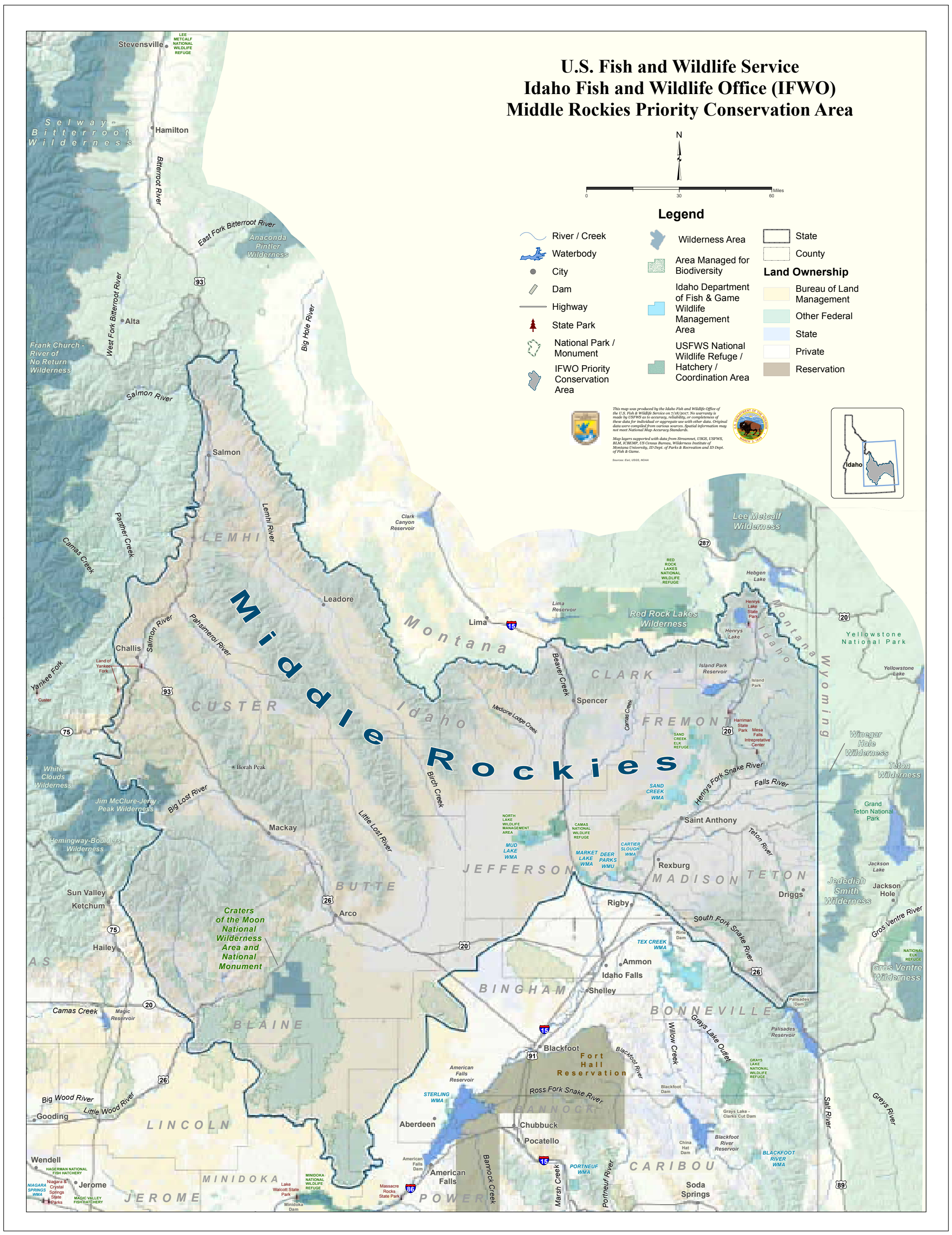

Figure 3. The Middle Rockies Priority Conservation Area covers an estimated 18.6% of the State of Idaho. This large, geographically complex area includes sage-steppe, alpine and sub-alpine habitats, and montane woodlands, as well as anadromous rivers and streams.

Conservation Strategy 1: Stabilize and enhance sagebrush ecosystems, targeting populations of Priority Species.

Priority Species: Aspen *(Populus tremuloides)*, Greater Sage-grouse *(Centrocercus urophasianus)*, Pygmy Rabbit *(Brachylagus idahoensis)*, Sagebrush Sparrow *(Artemisiospiza nevadensis)*, Sage Thrasher *(Oreoscoptes montanus)*, Rocky Mountain Bighorn Sheep *(Ovis canadensis canadensis)*, Townsend's Big-eared Bat *(Plecotus townsendii)*.

Goal 1a: Ensure resilient, ecologically functioning sagebrush ecosystem habitats capable of supporting native species in the Middle Rockies Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional blocks of sagebrush habitats to support Priority Species.

ii. Identify and restore habitats to ensure their use by Priority Species and that will promote connectivity within existing functional blocks of sage-steppe habitats.

iii. Identify and address threats to sagebrush ecosystem habitats and their surrounding habitats to ensure integrity.

iv. Protect and restore all sagebrush ecosystem habitat types to ensure habitats for all life-history needs of Priority Species are available and connected.

v. Conserve sage-grouse Priority Habitat Management Areas (PHMA) and Important Habitat Management Areas (IHMA) in Idaho as developed in Bureau of Land Management (BLM) and Forest Service (FS) Greater Sage-Grouse Approved Resource Management Plan Amendment of 2015[12].

Actions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 28, 29 (see complete list of Actions below).

Goal 1b: Ensure abundant, diverse, and resilient populations of native species within sagebrush ecosystems of the Middle Rockies Priority Conservation Area.

Conservation Objectives

i. Use identified Priority Species (indicator, umbrella, keystone, etc.) as needed to achieve strategic conservation. If needed, continue to identify species that require special consideration as appropriate (e.g., federally listed species or other species identified by partners).

ii. Protect or restore native habitats that support key life history components of Priority Species.

iii. Identify and address threats to Priority Species and their habitat.

iv. Promote connectivity between important habitat patches for Priority Species.

v. Promote genetic diversity of Priority Species in the sagebrush ecosystem.

vi. Protect native species associated with habitats of the sagebrush ecosystem within the Middle Rockies Priority Conservation Area.

vii. With partners, create opportunities to monitor populations of Priority Species and other indicators.

viii. With partners, evaluate Priority Species populations and habitat function to validate identified goals and objectives.

ix. As identified in the BLM and FS Greater Sage-Grouse Approved Resource Management Plan Amendment of 2015[12], protect sage-grouse populations at the established level (based on counts of males on leks).

Actions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33 (see below).

Goal 1c: Ensure that sagebrush ecosystems within and adjacent to the Middle Rockies Priority Conservation Area are biologically connected.

Conservation Objectives

i. Identify existing and potential corridors to existing functional blocks of sagebrush habitats in Idaho, Montana and Wyoming that will provide connectivity to Priority Species.

ii. With partners, plan restoration and/or mitigation efforts for sage-steppe habitats that connect adjacent areas or functional blocks of habitat to promote connectivity within and adjacent to the Middle Rockies Priority Conservation Area.

Actions: 13, 18, 26 (see below).

Conservation Actions for Middle Rockies Conservation Strategy 1:

Action 1: Assist the BLM/FS with implementing land-use and management plans developed for sage-grouse conservation[12].

Action 2: Assist BLM/FS with implementing priority actions identified by Snake-Salmon-Beaverhead Fire & Invasives Assessment Team (FIAT).

Action 3: Assist BLM/FS with Burned Area Emergency Rehabilitation (BAER) and Emergency Stabilization and Rehabilitation (ES&R) efforts.

Action 4: Assist BLM with planning, funding, and implementation of sage-grouse nesting habitat restoration.

Action 5: Assist the State of Idaho with implementing the Idaho Department of Lands Greater Sage-grouse Conservation Plan.

Action 6: Provide funding and technical assistance to Sage-grouse Initiative Strategic Watershed Action Team biologists.

Action 7: Provide funding and assistance to establish Sage-grouse in the Schools programs.

Action 8: Assist Idaho National Laboratory with Candidate Conservation Agreement (CCA) implementation.

Action 9: Assist IDFG with lek counts.

Action 10: Assist Natural Resources Conservation Service (NRCS) and other partners with conservation strategy for the Pioneers area.

Action 11: Identify and address species-specific threats and habitat needs for Priority Species in sagebrush ecosystems within the Middle Rockies Priority Conservation Area.

Action 12: Support research projects in the Middle Rockies Priority Conservation Area that will help refine management strategies for Priority Species in sagebrush ecosystems.

Action 13: Identify existing and potential corridors for Priority Species in sagebrush ecosystems that are needed for conservation. Consider habitat conditions adjacent to Middle Rockies Priority Conservation Area and work with partners (in Idaho, Montana, and Wyoming) to promote connectivity (including migratory corridors) and to promote genetic diversity for Priority Species, where appropriate.

Action 14: Work with partners to develop implementation and monitoring plans for all actions/objectives.

Action 15: Using climate and resiliency models as well as soil and vegetation requirements, assess predicted habitat suitability for pygmy rabbit, within the Middle Rockies Priority Conservation Area. Plan for long-term habitat shifts for this species.

Action 16. Collaborate with BLM, NRCS, IDFG, IDL, and private landowners to focus habitat restoration in Focal Sagebrush Habitat that will provide for sustainable populations of sagebrush obligate species as well as connectivity between Focal Sagebrush Habitat areas for pygmy rabbits.

Action 17: Encourage BLM, IDL, NRCS, and private landowners to employ a suite of tools to reduce invasive nonnative annual grasses (e.g., cheatgrass, medusahead) within and adjacent to pygmy rabbit suitable habitat within the Middle Rockies Conservation Team.

Action 18: Encourage BLM, NRCS, IDFG, IDL, and private landowners to employ a suite of tools to increase native species diversity within and adjacent to pygmy rabbit suitable habitat dominated by nonnative vegetation, including areas seeded post-fire with non-native plants.

Action 19: Collaborate with BLM, NRCS, IDFG, and IDL to accelerate the re-establishment of shrub cover in areas with limited mid- to late-seral sagebrush within identified Focal Pygmy Rabbit Sagebrush Habitat in the Middle Rockies Priority Conservation Area.

Action 20: Encourage BLM, NRCS, IDFG, and IDL to maintain adequate shrub cover (>30%) in deep soil areas of Focal Sagebrush Habitat Areas to promote conservation of pygmy rabbit within the Middle Rockies Priority Conservation Area.

Action 21: Work with partners to minimize grazing conflicts between bighorn sheep and domestic sheep.

Action 22: Assist partners with evaluation, repair, and replacement of water development structures for bighorn sheep (and other ungulates).

Action 23: Work with partners (internal and external) to increase public education on bighorn sheep, specific to disease transmission risk.

Action 24: Work with partners to minimize collisions with vehicles and bighorn sheep.

Action 25: Support research associated with bighorn sheep.

Action 26: Assist partners with augmentation and translocation of bighorn sheep.

Action 27: Collaborate with BLM, IDFG, Idaho Bird Observatory (IBO), and Audubon Society to establish breeding bird survey routes with in the Middle Rockies Priority Conservation Area for long term monitoring of sagebrush obligate songbirds (Brewer's sparrow, sagebrush sparrow, and sage thrasher) and sagebrush habitats.

Action 28: Collaborate with partners to incorporate sagebrush obligate songbird monitoring as early indicators to evaluate restoration effectiveness of habitat improvement projects within the Middle Rockies Priority Conservation Area.

Action 29: Work with land management agencies to enhance habitats necessary to sustain viable population levels of Priority Species.

Action 30: Identify hibernacula and roosting sites (including lava tubes, abandon mines, and caves, etc.) for Priority Species bats.

Action 31: Assist IDFG, BLM, Idaho National Laboratory (INL), and National Park Service (NPS) with winter and summer bat surveys.

Action 32: Assist with and foster development of cooperative agreement to develop and execute the North American Bat Monitoring Program[13] (NABat).

Action 33: Increase public education and engagement to reduce human-bat conflicts.

Conservation Strategy 2: Secure and enhance wetlands (e.g., Lacustrine and Palustrine) in the Middle Rockies Priority Conservation Area.

Priority Species: Trumpeter Swan *(Cygnus buccinator),* White-faced Ibis *(Plegadis chihi),* Greater Sage-grouse *(Centrocercus urophasianus).*

Goal 2a: Ensure resilient, ecologically functioning lacustrine and palustrine wetland ecosystems capable of supporting native species and habitat.

Conservation Objectives

i. Identify priority wetlands within the conservation area.

ii. Work with partners to create opportunities for potential wetland improvement and construction of highest priority wetlands.

iii. Work with partners on water conservation actions (incentives).

iv. Reduce and/or prevent invasive species introduction into priority wetlands.

v. Ensure objectives appropriate for individual wetlands are met.

Actions: 1, 2, 3, 4, 5 (see complete list of Actions below).

Goal 2b: Ensure abundant, diverse, and resilient populations of priority and native species within wetlands across the conservation area.

Conservation Objectives

i. Confirm Priority Species as well as appropriate indicator species as needed. Identify additional terrestrial species that require special consideration as appropriate (e.g., federally listed species or other species identified by partners).

ii. Identify and address threats to Priority Species and their habitat.

iii. With partners, create opportunities to implement population monitoring.

iv. With partners, evaluate species populations, as needed, and habitat function to validate identified goals and objectives.

Actions: 6, 7 (see below).

Goal 2c: Ensure that wetlands within and adjacent to the Middle Rockies Priority Conservation Area are biologically connected.

Conservation Objectives

i. Identify existing and potential wildlife corridors for Priority Species.

ii. Promote connectivity between important wetlands.

iii. Promote restoration efforts on wetlands adjacent to intact connected habitats.

iv. Coordinate with partners to ensure implementation of conservation actions do not conflict with adjacent conservation efforts.

Actions: 8 (see below).

Conservation Actions for Middle Rockies Conservation Strategy 2:

Action 1: Identify threats to wetland function and prioritize wetlands within the conservation area.

Action 2: Work with partners to create opportunities for potential wetland improvement.

Action 3: Work with partners on water conservation actions (incentives).

Action 4: Reduce and prevent invasive species introduction and habitat conversions.

Action 5: Set measurable objectives appropriate for individual wetland types.

Action 6: Prioritize wetland-dependent Priority Species of the Service and partners.

Action 7: Work with partners to create opportunities for population monitoring.

Action 8: Identify existing and potential wetlands corridors for Priority Species between wetlands within and adjacent to the Middle Rockies Priority Conservation Area.

Conservation Strategy 3: Enhance the viability of Middle Rockies Priority Conservation Area forested ecosystems for the continuing benefit of Priority Species.

Priority Species: Aspen *(Populus tremuloides)*, Whitebark Pine *(Pinus albicaulis)*, Grizzly Bear *(Ursus arctos)*, Townsend's Big-eared Bat *(Plecotus townsendii)*, Rocky Mountain Bighorn Sheep *(Ovis canadensis canadensis)*, Little Brown Bat *(Myotis lucifugus)*.

<u>Goal 3a: Ensure resilient, ecologically functioning forested ecosystems capable of supporting native terrestrial species and habitats.</u>

<u>Conservation Objectives</u>

i. Conserve and enhance remaining functional habitat blocks or mosaics that support Priority Species.

ii. Identify and address threats to habitats to ensure ecosystem integrity.

iii. Identify and restore human-impacted habitats to ensure their use by Priority Species and will promote connectivity within existing functional blocks of habitats.

iv. Promote connectivity between important habitat patches to sustain all life history stages of native terrestrial species.

v. Protect mosaics of habitat at multiple scales.

Actions: 1, 2, 3, 4, 5, 9 (see complete list of Actions below).

<u>Goal 3b: Ensure abundant, diverse, and resilient populations of native forest species within the Middle Rockies Priority Conservation Area.</u>

<u>Conservation Objectives</u>

i. Protect or restore native habitats that support key life history components of Priority Species and mutualistic species (i.e. Clark's nutcracker).

ii. Identify and address threats to Priority Species and their habitats.

iii. Promote connectivity between important habitat patches for Priority Species.

iv. Promote genetic diversity in the Priority Conservation Area.

v. Promote recovery of Priority Species.

Actions: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 (see below).

Goal 3c: Ensure that forest habitats within and adjacent to the Middle Rockies Priority Conservation Area are biologically connected.

Conservation Objectives

i. Identify existing and potential wildlife corridors that will provide connectivity for Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Middle Rockies Priority Conservation Area.

iii. With partners, plan restoration and/or mitigation efforts for habitats that connect adjacent areas or functional blocks of habitat.

Actions: 2, 6, 7, 12, 13 (see below).

Conservation Actions for Middle Rockies Conservation Strategy 3:

Action 1: Investigate current Priority Species distribution and abundance within the Priority Conservation Area Information from these projects will be used in conjunction with other occurrence data to target areas for habitat enhancement or management projects.

Action 2: Improve function and complexity of vegetation communities where necessary/appropriate to support or contribute to sustainable population levels of Priority Species.

Action 3: Work with land management agencies to enhance habitats necessary to sustain viable population levels of Priority Species.

Action 4: Identify hibernacula and roosting sites (including lava tubes, abandon mines, and caves, etc.) for Priority Species bats.

Action 5: Promote the whitebark pine restoration strategy[14] by providing research and funds towards tasks in order to protect and enhance whitebark pine stands and provide for resiliency into the future (collect whitebark pine seed; grow rust resilient seedlings; promote saving the relics; plant burned areas; treat stands; inventory and monitor).

Action 6: Identify and work with partners to improve our understanding of wildlife corridors the Middle Rockies Priority Conservation Area and surrounding states and National Forests.

Action 7: Perform habitat resistance analyses to identify potential wildlife corridors.

Action 8: Increase public education and engagement to reduce human-wildlife conflicts (bats, bears).

Action 9: Work with partners to minimize grazing conflicts between bighorn sheep and domestic sheep.

Action 10: Assist partners with evaluation, repair, and replacement of water development structures for bighorn sheep (and other ungulates).

Action 11: Work with partners (internal and external) to increase public education on bighorn sheep, specific to disease transmission risk.

Action 12: Work with partners to minimize collisions with vehicles and bighorn sheep.

Action 13: Support research associated with bighorn sheep.

Action 14: Assist partners with augmentation and translocation of bighorn sheep.

Action 15: Assist IDFG, BLM, INL, and NPS with winter and summer bat surveys.

Action 16: Assist with and foster development of cooperative agreement to develop and execute the North American Bat Monitoring Program[13] (NABat).

Action 17: Coordinate, where applicable, data collection associated with the direct response to the threat of white-nose syndrome.

Conservation Strategy 4: Secure and enhance riverine/riparian habitats in the Middle Rockies Priority Conservation Area for the continuing benefit of Priority Species.

Priority Species: Bull Trout *(Salvelinus confluentus),* Westslope Cutthroat Trout *(Oncorhynchus clarkia lewisi),* Yellowstone Cutthroat Trout *(Oncorhynchus clarkia bouvieri),* Chinook Salmon *(Oncorynchus tshawytscha),* Steelhead *(Oncorynchus mykiss irideus),* Rocky Mountain Tailed Frog *(Ascaphus montanus),* Western Pearlshell *(Margaritifera falcata),* American Beaver *(Castor canadensis),* Western Yellow-billed Cuckoo *(Coccyzus americanus occidentalis),* and Cottonwood/Willow Complexes.

Goal 4a: Ensure resilient, ecologically functioning riverine/riparian habitats capable of supporting native species in the Middle Rockies Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional blocks of streams, rivers, and associated riparian habitat supporting Priority Species.

ii. Identify and restore impacted riverine/riparian habitats to ensure their use by Priority Species, and promote connectivity within existing functional blocks of riverine/riparian habitat.

iii. Identify and address threats to streams, rivers, and associated riparian habitat to ensure ecosystem integrity.

iv. Protect and restore streams, rivers, and associated riparian habitat to ensure habitats for all life-history needs of Priority Species are available and connected.

Actions: 1, 2, 4, 5, 6, 7, 9, 11, 12, 13, 14 (see complete list of Actions below).

Goal 4b: Ensure abundant, diverse (including life histories), and resilient populations of Priority Species within the riverine/riparian habitats of the Middle Rockies Priority Conservation Area.

Conservation Objectives

i. Protect or restore native habitats that support key life history components of Priority Species.

ii. Identify and address threats to Priority Species and their habitat.

iii. Promote connectivity between important habitat patches for Priority Species.

Actions: 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17 (see below).

Goal 4c: Ensure that riverine/riparian habitats within the Middle Rockies Priority Conservation Area are biologically connected to adjacent habitats.

Conservation Objectives

i. Identify existing and potential riverine/riparian corridors to existing functional blocks of riverine/riparian habitats in the Salmon and Upper Snake River drainages that will provide connectivity for Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Priority Conservation Area.

iii. With partners, plan restoration and/or mitigation efforts for riverine/riparian habitats that connect adjacent areas or functional blocks of riverine/riparian habitat.

Actions: 10, 12 (see below).

Conservation Actions for Middle Rockies Conservation Strategy 4:

Action 1: Using climate and resiliency models assess predicted habitat suitability for bull trout, Yellowstone cutthroat, westslope cutthroat, and salmon and focus on suitable areas for Conservation Actions (Focal Drainages). Assessment of suitable habitat should consider susceptibility of drainages to wildfire.

Action 2: Remove passage barriers within Focal Drainages (identified in 2015 Bull Trout Recovery Plan and RUIP[15]), and a factor influencing Yellowstone cutthroat distribution[16]): a) culvert replacements, b) fish ladder installation, c) fish screen installation, d) thermal barrier remediation, e) velocity barrier remediation where not natural.

Action 3: Control harmful non-native fish species within Focal Drainages (identified in 2015 Bull Trout Recovery Plan and RUIP and a concern Yellowstone cutthroat trout[14]).

Action 4: Restore or enhance salmonid fluvial and adfluvial life histories, where appropriate, within Focal Drainages.

Action 5: Within Focal Drainages assess human water use in drainage and secure necessary in-stream flow sufficient for healthy salmonid populations (identified as Primary Threat in RUIP[13] and identified as a factor influencing Yellowstone cutthroat trout populations) and as needed for tailed frog and western pearlshell.

Action 6: Assess the suitability of existing flow regimes to sustain cottonwood/willow complexes. Where flow regimes have been altered by dams and/or irrigation, investigate the feasibility, and work with partners, to establish a more natural flow regime.

Action 7: Reduce sedimentation and other water quality impacts in Focal Drainages and where impacting western pearlshell and tailed frog.

Action 8: Assess non-native diseases and/or parasite infections and address as feasible.

Action 9: Develop implementation and monitoring plans with partners.

Action 10: Consider habitat conditions adjacent to Middle Rockies Priority Conservation Area and work with partners to promote connectivity of habitats where appropriate.

Action 11: Restore stream habitat by implementing restoration projects where stream habitat is lacking complexity by placing wood, doing riparian plantings, restoring grade control, nutrient replacement, and other stream restoration techniques (e.g., beaver introduction or analogs).

Action 12: Work with partners to identify cottonwood/willow complexes that are not functioning appropriately and collaboratively restore these habitats to facilitate recruitment of cottonwoods and willows.

Action 13: Work with partners to address invasive species encroachment into riparian habitats.

Action 14: Leverage opportunities and partnerships to promote conservation within the Priority Conservation Area (Land and Water Conservation Fund, Bonneville Power Administration funds, watershed groups, etc.).

Action 15: Gather information regarding the status of western pearlshell, tailed frog, beaver, and cottonwood/willow complexes. Assess status, current distribution and abundance, etc. to identify key areas to conduct restoration activities.

Action 16: Work with partners to gather information regarding the status of yellow-billed cuckoo. Identify cottonwood/willow complexes which are selected for use by yellow-billed cuckoo.

Action 17: Work with partners to monitor yellow-billed cuckoo prey base and restore or enhance those areas where feasible.

APPENDIX III: Owyhee Uplands Priority Conservation Area

The Owyhee Uplands Conservation Team identified three conservation targets addressed with the following Conservation Strategies: 1) sagebrush ecosystems, 2) aquatic and wet meadow systems, and 3) aspen ecosystems. Within the Owyhee Uplands (Figure 4), the aquatic and wet meadow systems as well as aspen comprise important habitats nested within the greater sagebrush ecosystems which predominates this region of the state. The aquatic-wet meadow and aspen habitat/ecosystems are integral to the life histories of many of the species that are regarded as members of the sagebrush ecosystem. This area supports nine IFWO Priority Species, none of which are currently listed under the Act. The Owyhee Uplands Priority Conservation Area area was selected to focus IFWO conservation efforts on the greater sage-grouse, which continues to be a high conservation priority of the Service. The boundaries of the Owyhee Uplands Priority Conservation Area were based upon the location of habitat for the greater sage-grouse, and contains the largest contiguous core habitat for greater sage-grouse in Idaho.

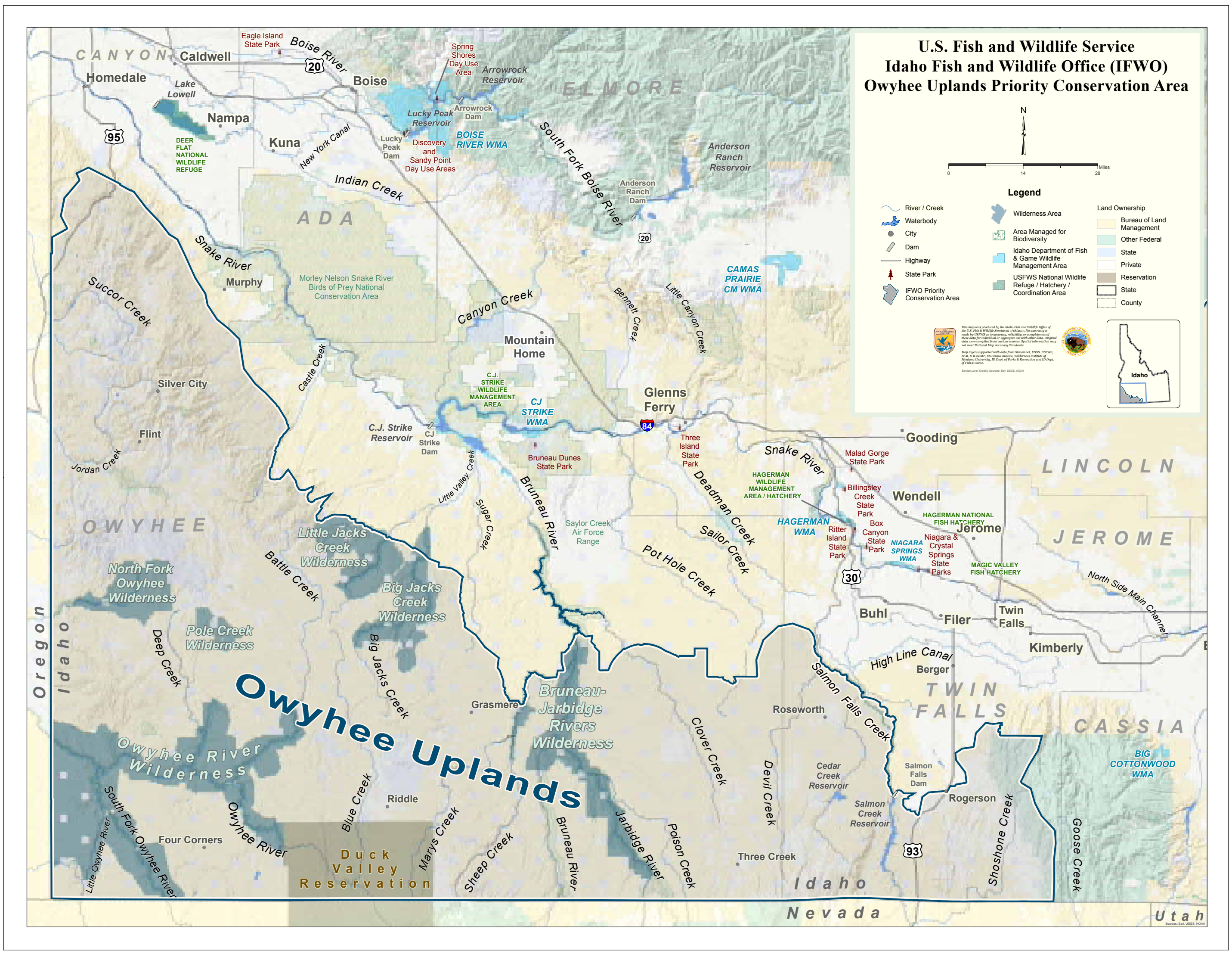

Figure 4. Owyhee Uplands Priority Conservation Area covers an estimated 8.2% of the State of Idaho and is comprised mostly of sagebrush habitats with associated wetlands, woodlands, and canyon lands.

Conservation Strategy 1: Secure and enhance native, obligate sagebrush species and their habitats in the Owyhee Uplands Priority Conservation Area.

Priority Species: Greater Sage-grouse *(Centrocercus urophasianus)*, Pygmy Rabbit *(Brachylagus idahoensis)*, Slickspot Peppergrass *(Lepedium papilliferum)*, Sagebrush Sparrow *(Artemisiospiza nevadensis)*, Sage Thrasher *(Oreoscoptes montanus)*.

Goal 1a: Ensure resilient, ecologically functioning sagebrush ecosystems capable of supporting native species and habitats in the Owyhee Uplands Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional blocks of sagebrush habitats supporting sagebrush Priority Species.

ii. Identify and restore large enough blocks of functioning sagebrush habitat to support sagebrush Priority Species. Focus habitat restoration efforts to maintain or enhance resistance and resiliency of sagebrush habitats.

iii. Identify and address threats to sagebrush habitats.

iv. Promote connectivity between important sagebrush habitat patches.

v. Protect mosaics of sagebrush habitat at multiple scales.

vi. Conserve sage-grouse Priority Habitat Management Areas (PHMA) and Important Habitat Management Areas (IHMA) in Idaho as developed in Bureau of Land Management (BLM) and Forest Service (FS) Greater Sage-Grouse Approved Resource Management Plan Amendment of 2015[17].

Actions: 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31 (see complete list of Actions below).

Goal 1b: Ensure abundant, diverse, and resilient populations of sagebrush obligate species within their habitats in the Owyhee Uplands Priority Conservation Area.

Conservation Objectives

i. Confirm sagebrush Priority Species as well as appropriate indicator as needed. Identify additional sagebrush obligate species that require special consideration as appropriate (e.g., federally listed species or other species identified by partners).

ii. Protect or restore native sagebrush habitats that support key life history components of sagebrush Priority Species.

iii. Identify and address threats to sagebrush Priority Species and their habitats.

iv. Promote connectivity between important sagebrush habitat patches.

v. Promote genetic diversity of sagebrush Priority Species.

vi. Promote recovery of sagebrush Priority Species.

vii. Protect mosaics of sagebrush habitat at multiple scales.

viii. Protect unique sagebrush native species associated with the Owyhee Uplands Priority Conservation Area.

ix. As identified in the BLM and FS Greater Sage-Grouse Approved Resource Management Plan Amendment of 2015[17], protect sage-grouse populations at the established level (based on counts of males on leks).

Actions: 1, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31 (see below).

Goal 1c: Ensure that sagebrush habitats within the Owyhee Uplands Priority Conservation Area are biologically connected to adjacent habitats.

Conservation Objectives

i. Identify existing and potential corridors to existing functional blocks of sagebrush habitats in the Owyhee Uplands Priority Conservation Area that will provide connectivity to sagebrush Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Owyhee Uplands Priority Conservation Area.

iii. With partners, plan restoration and/or mitigation efforts for sagebrush habitats that connect adjacent areas or functional blocks of sagebrush habitat.

Actions: 13, 16, 22, 32 (see below).

Conservation Actions for Owyhee Uplands Conservation Strategy 1:

Action 1: Assist the BLM with implementing management plans[17] developed for sage-grouse conservation.

Action 2: Assist BLM with implementing priority actions identified by the Boise District and Twin Falls District Fire & Invasives Assessment Team (FIAT).

Action 3: Assist BLM with Burned Area Emergency Rehabilitation (BAER) and Emergency Stabilization and Rehabilitation (ES&R) efforts.

Action 4: Assist BLM with planning, funding, and implementation of Bruneau Owyhee Sage-Grouse Habitat (BOSH) Project.

Action 5: Assist BLM with planning, funding, and implementation of the Tri-State Fuels Breaks Project.

Action 6: Assist the State of Idaho with implementing the Idaho Department of Lands Greater Sage-grouse Conservation Plan[18].

Action 7: Provide funding and technical assistance to Sage-grouse Initiative (SGI) Strategic Watershed Action Team biologists.

Action 8: Provide funding and assistance to establish Sage-grouse in the Schools programs.

Action 9: Assist Idaho Department of Fish and Game (IDFG) with lek counts.

Action 10: Assist Natural Resource Conservation Service (NRCS) and other partners with conservation strategy for the Owyhee Uplands Priority Conservation Area.

Action 11: Identify and address species-specific threats and habitat needs for Priority Species in the Owyhee Uplands Priority Conservation Area.

Action 12: Support research projects in the Owyhee Uplands Priority Conservation Area that will help refine management strategies for Priority Species in sagebrush habitats.

Action 13: Identify existing and potential corridors for Priority Species in the Owyhee Uplands Priority Conservation Area that are needed for conservation.

Action 14: Work with partners to develop implementation and effectiveness monitoring plans for all actions.

Action 15: Using climate and resiliency models, assess predicted habitat suitability for slickspot peppergrass and pygmy rabbit (Focal Sagebrush Habitats), within the Owyhee Uplands Priority Conservation Area.

Action 16: Collaborate with BLM, NRCS, IDFG, IDL, Mountain Home Air Force Base (MHAFB), private landowners, and tribes to focus habitat restoration in Focal Sagebrush Habitat that will provide for sustainable populations of sagebrush-steppe obligate species as well as connectivity between Focal Sagebrush Habitat areas for pygmy rabbit and slickspot peppergrass.

Action 17: Collaborate with partners to develop a recovery plan for slickspot peppergrass, including within the Owyhee Uplands Priority Conservation Area.

Action 18: Encourage BLM, IDL, NRCS, and private landowners, and BLM livestock permittees to employ a suite of tools to reduce invasive non-native annual grasses (e.g., cheatgrass, medusahead) within and adjacent to slickspot peppergrass Occupied Habitat and pygmy rabbit suitable habitat within the Owyhee Uplands Priority Conservation Area.

Action 19: Encourage BLM, NRCS, IDFG, IDL, private landowners, Tribes, and BLM livestock permittees to employ a suite of tools to increase species diversity within and adjacent to slickspot peppergrass Occupied Habitat and pygmy rabbit suitable habitat, that dominated by non-native vegetation, including areas seeded post-fire with non-native plants.

Action 20: Fund pilot projects that will identify new techniques for maintaining or re-establishing resilience and resistance of sagebrush habitats, with an emphasis on native shrubs, grasses, and forbs.

Action 21: Collaborate with BLM, NRCS, IDFG, IDL, MHAFB, and tribes to accelerate the re-establishment of shrub cover in areas with limited mid- to late-seral sagebrush within identified Focal Sagebrush Habitat for slickspot peppergrass and pygmy rabbit in the Owyhee Uplands Priority Conservation Area.

Action 22: Actively engage in and encourage partner collaboration with Tribes, IDFG, Nevada Department of Wildlife, and Oregon Department of Fish and Wildlife to promote sagebrush habitat connectivity for pygmy rabbit across tribal and state boundaries, where appropriate.

Action 23: Encourage BLM, NRCS, IDFG, IDL, and tribes to maintain adequate shrub cover (>30 percent total shrub cover) in deep soil areas of Focal Sagebrush Habitat Areas to promote conservation of pygmy rabbit within the Owyhee Uplands Priority Conservation Area.

Action 24: In collaboration with the LEPA Technical Team, BLM, MHAFB, IDL, BLM livestock permittees, and IDFG, identify priority Elemental Occurrences (EOs) within the Owyhee Uplands Priority Conservation Area for slickspot peppergrass habitat restoration and population augmentation or re-establishment through the Recovery planning process.

Action 25: In collaboration with BLM, MHAFB, IDL, BLM livestock permittees, and IDFG, maintain or re-establish native grasses, forbs, and shrubs as well as biological soil crusts at identified priority EOs to benefit slickspot peppergrass and the insect pollinators on which it depends.

Action 26: In collaboration with BLM, MHAFB, IDL, BLM livestock permittees, and IDFG, avoid or minimize ground disturbance and the incidence of invasive non-native plants within and adjacent to identified priority EOs to benefit slickspot peppergrass and the slickspot microsites on which it depends.

Action 27: In collaboration with BLM, MHAFB, IDL, and IDFG, identify appropriate locations for population augmentation or reintroduction as part of slickspot peppergrass recovery.

Action 28: In collaboration with BLM, MHAFB, IDL, NRCS, tribes, and IDFG, develop implementation and monitoring plans for sagebrush habitat activities to ensure pygmy rabbit conservation objectives are being met.

Action 29: In collaboration with BLM, MHAFB, IDL, and IDFG, continue to implement implementation and effectiveness monitoring to ensure slickspot peppergrass conservation objectives are being met. Develop and implement appropriate monitoring to determine success of population augmentation and reintroduction efforts, as needed.

Action 30: Collaborate with BLM, IDFG, Idaho Bird Observatory, Audubon to establish breeding bird survey routes within the Owyhee Uplands Priority Conservation Area for long term monitoring of sagebrush obligate songbirds (Brewer's sparrow, sagebrush sparrow, and sage thrasher) and sagebrush habitats.

Action 31: Collaborate with partners to incorporate sagebrush obligate songbird monitoring as early indictors to evaluate restoration effectiveness of habitat improvement projects within the Owyhee Uplands Priority Conservation Area.

Conservation Strategy 2: Secure and enhance American beaver, Columbia spotted frog, and interior redband trout populations and their habitats (lotic, lentic, and wet meadow) within the Jarbidge, Bruneau, and Owyhee watersheds of the Owyhee Uplands Priority Conservation Area.

Priority Species: American Beaver *(Castor canadensis)*, Columbia Spotted Frog *(Great Basin DPS; Rana luteiventris)*, and Interior Redband Trout *(Oncorynchus mykiss gairdneri)*.

Goal 2a: Ensure resilient, ecologically functioning aquatic habitats capable of supporting native aquatic species in the Owyhee Uplands Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional lotic, lentic, and wetland aquatic habitats supporting aquatic Priority Species.

ii. Identify and restore large enough blocks of functioning aquatic habitat to support aquatic Priority Species. Focus habitat restoration efforts to maintain or enhance resistance and resiliency of aquatic habitats.

iii. Identify and address threats to aquatic habitats.

iv. Promote connectivity between important aquatic habitat patches.

v. Protect aquatic habitat at multiple scales.

Actions: 1, 2, 3, 4, 5, 6, 7, 8 (see complete list of Actions below).

Goal 2b: Ensure abundant, diverse, and resilient populations of native aquatic species within their habitats in the Owyhee Uplands Priority Conservation Area.

Conservation Objectives

i. Identify aquatic Priority Species as well as appropriate indicator species as needed. Identify additional aquatic species that require special consideration as appropriate (e.g., federally listed species or other species identified by partners).

ii. Protect or restore aquatic habitats that support key life history components of aquatic Priority Species.

iii. Identify and address threats to aquatic Priority Species and their habitats.

iv. Promote connectivity between important aquatic habitat patches.

v. Promote genetic diversity of aquatic Priority Species.

vi. Promote recovery of aquatic Priority Species.

vii. Protect mosaics of aquatic habitat at multiple scales.

viii. Protect unique aquatic native species associated with the Owyhee Uplands Priority Conservation Area.

Actions: 2, 3, 4, 6, 7, 8 (see below).

Goal 2c: Ensure that aquatic habitats within the Owyhee Uplands Priority Conservation Area are biologically connected to adjacent habitats outside of the area.

Conservation Objectives

i. Identify existing and potential corridors to existing functional reaches of aquatic habitats in the Owyhee Uplands Priority Conservation Area that will provide connectivity to aquatic Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Owyhee Uplands Priority Conservation Area.

iii. With partners, plan restoration and/or mitigation efforts for aquatic habitats that connect adjacent areas or functional reaches of aquatic habitat.

Actions: 1, 9 (see below).

Conservation Actions for Owyhee Uplands Conservation Strategy 2:

Action 1. Use climate and resiliency models and GIS mapping to identify the configuration of predicted moderate to high quality future habitat for Columbia spotted frog, interior redband trout, and beaver in the Jarbidge, Bruneau, and Owyhee watersheds. Identify these areas as Focal Drainages and Focal Ponds/Wetlands.

Action 2. Collaborate with The Nature Conservancy (TNC), Trout Unlimited (TU), BLM, Ducks Unlimited (DU), IDL, and IDFG to restore or enhance beaver populations and their habitat, where appropriate.

Action 3. Collaborate with BLM, TU, and IDFG to remove stream passage barriers to benefit redband trout within Focal Drainages. Projects to remediate current stream passage barriers may include culvert replacement, fish ladder installation, fish screen installation, and thermal barrier remediation.

Action 4. Collaborate with IDFG to evaluate the presence of invasive non-native species and remove/control invasive non-native fish (primarily small-mouth bass) and bullfrogs, as needed, focusing on Focal Drainages and Focal Ponds/Wetlands.

Action 5. Collaborate with BLM, IDA, NRCS, Animal and Plant Health Inspection Service (APHIS), and TU and provide funding to reduce sedimentation and pesticide contamination of streams and wetlands in Focal Drainages.

Action 6. Collaborate with U.S. Geological Survey (USGS), DU, and IDFG to fund assessments of non-native disease and/or parasite infection (interior redband trout; Columbia spotted frog) and to treat as needed and feasible.

Action 7. Collaborate with NRCS, TU, DU, private landowners, and IDFG to encourage the use of flood irrigation within historic floodplains (rather than pivot irrigation) for conservation of wetland habitats.

Action 8. Collaborate with BLM, NRCS, USGS, TU, and IDFG to develop implementation and monitoring plans for aquatic habitat activities.

Action 9. Actively engage in and encourage partner collaboration to promote aquatic habitat connectivity across tribal and state boundaries, where appropriate.

Conservation Strategy 3: Aspen Habitats: Secure and enhance aspen habitats in the Owyhee Uplands Priority Conservation Area and the species that depend upon them.

Aspen Habitats Priority Species: Aspen *(Populus tremuloides)*, American Beaver *(Castor canadensis)*.

Goal 3a: Ensure resilient, ecologically functioning aspen habitats capable of supporting native species and habitats in the Owyhee Uplands Priority Conservation Area.

Conservation Objectives

i. Conserve remaining functional blocks of aspen habitats supporting aspen Priority Species.

ii. Identify and restore large enough blocks of functioning aspen habitat to support aspen Priority Species. Focus habitat restoration efforts to maintain or enhance resistance and resiliency of aspen habitats.

iii. Identify and address threats to aspen habitats.

iv. Promote connectivity between important aspen habitat patches.

v. Protect aspen habitat at multiple scales.

Actions: 1, 2, 3, 4, 5, 6, 7, 8, 9 (see complete list of Actions below).

Goal 3b: Ensure abundant, diverse, and resilient populations of aspen and species that depend on this habitat in the Owyhee Uplands Priority Conservation Area.

Conservation Objectives

i. Confirm aspen Priority Species as well as appropriate indicator species as needed. Identify additional species dependent on aspen that require special consideration as appropriate (e.g., federally listed species or other species identified by partners).

ii. Protect or restore native aspen habitats that support key life history components of aspen Priority Species.

iii. Identify and address threats to aspen Priority Species and their habitats.

iv. Promote connectivity between important aspen habitat patches.

v. Promote genetic diversity of aspen Priority Species.

vi. Promote recovery of aspen Priority Species.

vii. Protect mosaics of aspen habitat at multiple scales.

viii. Protect unique native species dependent on aspen that are associated with the Owyhee Uplands Priority Conservation Area.

Actions: 1, 2, 3, 4, 5, 6, 7 (see below).

Goal 3c: Ensure that aspen habitats within the Owyhee Uplands Priority Conservation Area are biologically connected to adjacent habitats.

Conservation Objectives

i. Identify existing and potential corridors to existing functional blocks of aspen habitats in the Owyhee Uplands Priority Conservation Area that will provide connectivity to aspen Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Owyhee Uplands Priority Conservation Area.

iii. With partners, plan restoration and/or mitigation efforts for aspen habitats that connect adjacent areas or functional blocks of aspen habitat.

Actions: 1, 2, 8 (see below).

Conservation Actions for Owyhee Uplands Conservation Strategy 3:

Action 1. Meet with IDFG and other partners to determine their willingness to collaboratively develop an aspen conservation strategy for the Owyhee Uplands Priority Conservation Area.

Action 2. Using climate and resiliency models and land condition data, assess predicted habitat changes in the aspen habitats within the Owyhee Uplands Priority Conservation Area. Identify resilient aspen habitat patches (Focal Aspen Sites) with TNC, IDFG, NRCS, USGS, and BLM. Prioritize predicted moderate to high quality future habitat (Focal Aspen Areas) to focus future conservation/restoration actions in these Focal Aspen Habitat Sites/Areas.

Action 3. Collaborate with IDFG, BLM, NRCS, private landowners, USGS, Tribes, and Audubon to maintain or enhance Focal Aspen Sites. Techniques could include silvicultural practices (coppice management), prescribed burning, or domestic and wild large ungulate management through fencing or herd management.

Action 4. Collaborate with IDFG, BLM, NRCS, private landowners, USGS, Tribes, TNC, and TU to restore or enhance beaver populations, where appropriate.

Action 5. In collaboration with IDFG, BLM, NRCS, private landowners, USGS, Tribes, TNC, TU, Audubon, and the Idaho Conservation League, provide funding and input on a public education program on the conservation of aspen habitat and its value to Idaho's wildlife legacy.

Action 6: In collaboration with BLM, NRCS, private landowners, USGS, Tribes, and IDFG, lead an effort to monitor aspen stand health over time, inclusive of the extent of current and future Sudden Aspen Decline (SAD), within and adjacent to the Owyhee Uplands through techniques such as satellite photo analyses, aerial photo analyses, and stand condition verification field visits.

Action 7: In collaboration with BLM, NRCS, private landowners, USGS, Tribes, and IDFG, develop implementation and effectiveness monitoring plans for projects designed to benefit aspen.

Action 8: Actively engage in and encourage partner collaboration between Tribes, Nevada Department of Wildlife, Oregon Department of Fish and Wildlife, and the Humboldt Toiyabe National Forest to promote aspen connectivity across tribal and state boundaries, where appropriate.

Appendix IV: Selkirk Cabinet-Yaak Priority Conservation Area

The boundaries of the Selkirk Cabinet-Yaak Priority Conservation Area encompass the northern Idaho Panhandle from the Canada-Montana-Washington borders to the Pend Oreille Basin to the south. Diverse forests, cool temperatures and abundant precipitation support diverse assemblages of fish and wildlife species. The Selkirk Cabinet-Yaak Conservation Team identified four conservation strategies to conserve and restore: 1) native salmonids in the Priest and Pend Oreille Basins, 2) terrestrial species in the Selkirk Mountain ecosystem, 3) Kootenai Basin ecosystems and watersheds, and 4) riparian and wetland habitats (Figure 5). The area contains 14 species identified by the IFWO as priorities, six of which are federally listed as threatened or endangered. Numerous glacial lakes occur within the area, including Lake Pend Oreille, the largest lake in Idaho. Remnant wetlands, riparian habitat and dry conifer forest along the Kootenai River Valley provide important wildlife corridors between the flanking mountain ranges.

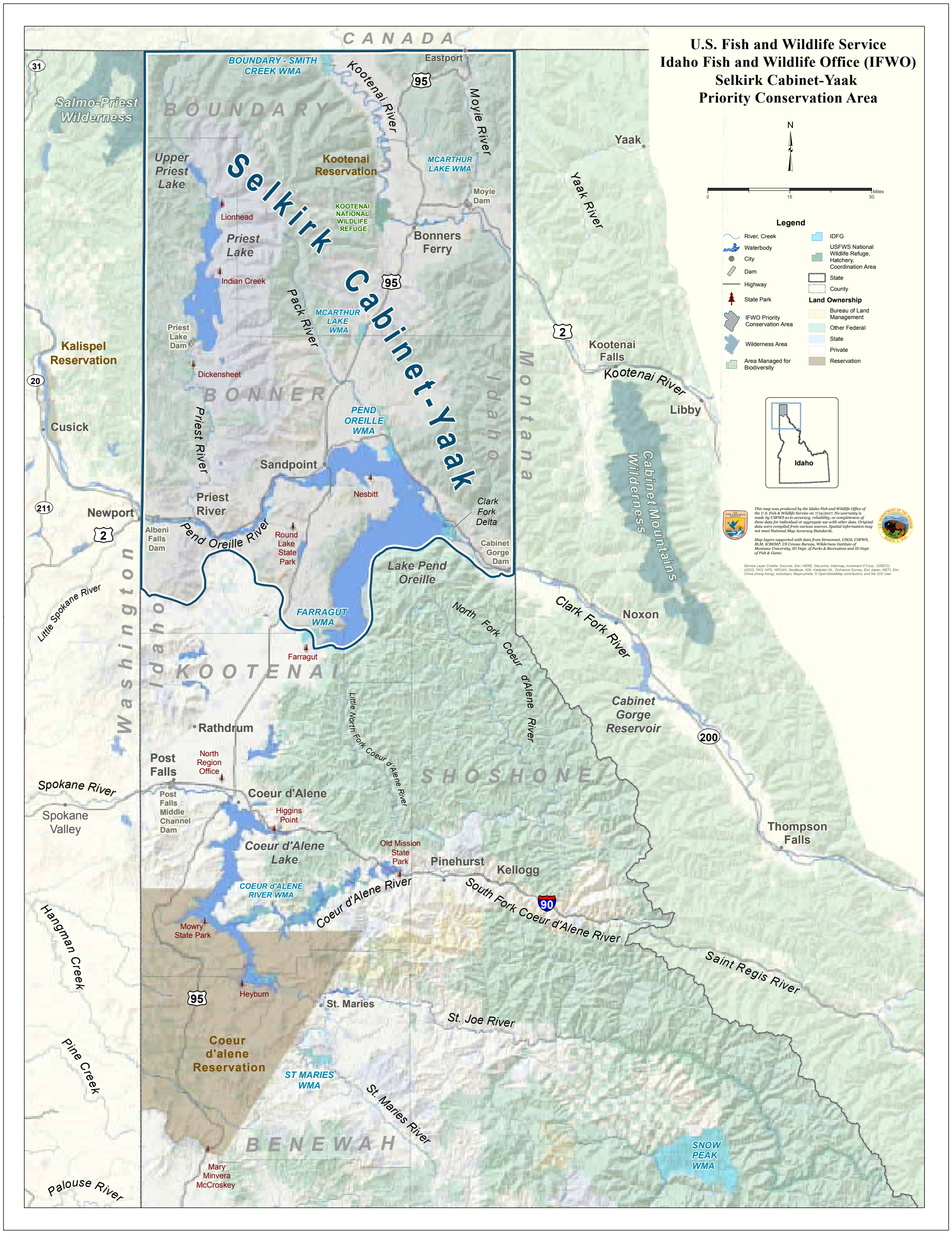

Figure 5. The Selkirk Cabinet-Yaak Priority Conservation Area occupies an estimated 3.3% of the state. It contains unique wet and mesic forest, as well as large lake and aquatic systems unique in Idaho.

Conservation Strategy 1: Enhance native salmonid populations within the Priest and Pend Oreille Basin.

Priority Species: Bull Trout *(Salvelinus confluentus),* Westslope Cutthroat Trout *(Oncorhynchus clarkia lewisi).*

Goal 1a: Ensure resilient, ecologically functioning ecosystems capable of supporting native aquatic species and habitats in the Priest and Pend Oreille Basins.

Conservation Objectives

i. Conserve remaining functional blocks of streams and rivers supporting aquatic Priority Species.

ii. Identify and restore impacted aquatic habitats to ensure their use by aquatic Priority Species. Maintain and enhance the resilience of these habitats.

iii. Promote connectivity between existing functional networks of aquatic habitat within the Priest and Pend Oreille Basins.

iv. Identify and address threats to aquatic habitats and their surrounding terrestrial and riparian habitats to ensure aquatic integrity.

v. Protect and restore mosaics of aquatic habitat types (lakes, rivers, streams, and associated wetland and riparian areas) to ensure habitats for all life-history needs of aquatic Priority Species are available and connected.

Actions: 1, 2, 3, 4, 5, 6, 7 (see complete list of Actions below).

Goal 1b: Ensure abundant, diverse, and resilient populations of native aquatic species within the habitats of the Priest and Pend Oreille River basin.

Conservation Objectives

i. Protect or restore native habitats that support key life history components of Priority Species.

ii. Identify and address threats to aquatic Priority Species and their habitat.

iii. Promote connectivity between important habitat patches for aquatic Priority Species within the Priest and Pend Oreille Basins.

iv. Promote genetic diversity of Priority Species in the aquatic habitats.

v. Promote recovery of Priority Species.

Actions: 3, 4, 5, 6, 7, 8, 9 (see below).

Goal 1c: Ensure that key aquatic systems within the Priest and Pend Oreille Basins are biologically connected to other river systems and adjacent to the Selkirk Cabinet-Yaak Priority Conservation Area.

Conservation Objectives

i. Identify existing and potential aquatic corridors to existing functional blocks of aquatic habitats in the Priest and Pend Oreille River systems that will provide connectivity to aquatic Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Selkirk Cabinet-Yaak Priority Conservation Area.

iii. With partners, focus restoration and/or mitigation efforts on aquatic habitats that connect functional blocks of aquatic habitat within the Selkirk Cabinet-Yaak Priority Conservation Area to adjacent habitats as appropriate.

Actions: 3, 9 (see below).

Conservation Actions for Selkirk Cabinet-Yaak Conservation Strategy 1:

Action 1: Protect, enhance, and restore key riparian habitats and their ecological function so that they support or contribute to sustainable population levels of Priority Species.

Action 2: Improve channel complexity within focal drainages.

Action 3: Restore fish passage at key dams.

Action 4: Restore and provide passage to migratory fish by removing potential human-caused barriers, i.e. impassable culverts, hydraulic head-cuts, water diversion blockages, landslides, and impassable deltas.

Action 5: Incorporate climate adaptive planning when identifying key areas for conservation and restoration.

Action 6: Work with partners to prevent, identify, contain, and control invasive species, and to restore affected native habitats.

Action 7: Reduce threats from introduced fish species.

Action 8: Maintain or increase the total number of identified local populations of Priority Species, and maintain the broad distribution of local populations.

Action 9: Identify additional areas for connectivity between aquatic habitats within and adjacent to the Selkirk Cabinet-Yaak Priority Conservation Area.

Conservation Strategy 2: Enhance the viability of the Selkirk Mountains ecosystem for the continuing benefit of native species.

Priority Species: Woodland Caribou *(Rangifer tarandus)*, Canada Lynx *(Lynx canadensis)*, Grizzly Bear *(Ursus arctos)*, Fisher *(Martes pennanti)*, Whitebark Pine *(Pinus albicaulis)*, Little Brown Bat *(Myotis lucifugus)*, Western Bumble Bee *(Bombus occidentalis)*.

<u>Goal 2a: Ensure resilient, ecologically functioning Selkirk Mountains ecosystem capable of supporting native terrestrial species and habitats.</u>

<u>Conservation Objectives</u>

i. Conserve and enhance remaining functional habitat blocks or mosaics that support Priority Species.

ii. Identify and address threats to habitats to ensure ecosystem integrity.

iii. Identify and restore habitat blocks large enough to support native and Priority Species, and focus efforts on maintaining and enhancing the resiliency of these native habitats.

iv. Promote connectivity between important habitat patches to sustain all life history stages of native terrestrial species.

v. Protect mosaics of habitat at multiple scales.

Actions: 1, 2, 3, 4, 7, 8, 9, 10, 13 (see complete list of Actions below).

Goal 2b: Ensure abundant, diverse, and resilient populations of native Selkirk Mountains species within their habitats.

Conservation Objectives

i. Protect or restore native habitats that support key life history components of Priority Species.

ii. Identify and address threats to Priority Species and their habitats.

iii. Promote connectivity between important habitat patches for Priority Species within the Selkirk Mountains Ecosystem.

iv. Promote genetic diversity of Priority Species within the Selkirk Mountains Ecosystem.

v. Promote recovery of Priority Species.

Actions: 5, 6, 7, 10, 11, 12, 13, 14, 15 (see below).

Goal 2c: Ensure the Selkirk Mountains are biologically connected to habitats within and adjacent to the Selkirk Cabinet-Yaak Priority Conservation Area.

Conservation Objectives

i. Identify existing and potential wildlife corridors that will provide connectivity for Priority Species.

ii. With partners, promote connectivity between important habitat patches adjacent to the Selkirk Mountains Ecosystem.

iii. With partners, focus restoration and/or mitigation efforts on habitats that connect functional blocks of habitat between the Selkirk Cabinet-Yaak Priority Conservation Area and adjacent areas.

Actions: 4, 8, 9, 10, 11 (see below).

Actions for Selkirk Cabinet-Yaak Conservation Strategy 2:

Action 1: Work with partners to conserve, protect, and enhance forest mosaics that contribute to sustainable populations of Priority Species.

Action 2: Continue to coordinate with partners on developing and implementing a wildland fire use plan to allow for non-suppression of naturally ignited fires when appropriate, and the implementation of a prescribed fire program to maintain suitable habitats for Priority Species.

Action 3: Improve function and complexity of mainstem riparian habitats to levels that support or contribute to sustainable population levels of Priority Species.

Action 4: Incorporate climate adaptive planning when identifying key areas for conservation and restoration.

Action 5: Work with partners to reduce human-caused mortalities of Priority Species, particularly in the wildlife-urban interface.

Action 6: Working with partners, identify the current distribution and abundance of Priority Species within the Selkirk Mountains Ecosystem.

Action 7: Update and expand the population viability analysis (PVA) for trans-boundary woodland caribou in southern British Columbia.

Action 8: Help partners identify and prioritize areas for conservation, acquisition, and/or restoration.

Action 9: Work with partners to protect, restore, or enhance existing wildlife corridors within the Selkirk Mountains Ecosystem.

Action 10: Assess and restore genetic connectivity for Priority Species between the Selkirk Mountains Ecosystem and adjacent ecosystems.

Action 11: Begin scoping efforts to provide a wildlife corridor between the Selkirk and Cabinet Mountains at McArthur Lake.

Action 12: Work with partners to implement standardized monitoring programs for Priority Species within the Selkirk Mountains Ecosystem.

Action 13: Work with Partners to create pollinator habitat and minimize the use of pesticides where practical.

Action 14: Work with partners and stakeholders to develop and implement a statewide strategic plan for white-nose syndrome (WNS), including protocols for surveillance and response to the introduction of WNS in Idaho.

Action 15: Assist our partners with conducting bat surveys, identifying summer roosts and winter hibernacula, and developing/implementing the North American Bat Monitoring Program (NABat)[13].

Conservation Strategy 3: Maintain and restore healthy ecosystems and watersheds within the Kootenai Basin to ensure the continued persistence, health, and diversity of native species.

Priority Species: Kootenai White Sturgeon *(Acipenser transmontanus),* Bull Trout *(Salvelinus confluentus),* Westslope Cutthroat Trout *(Oncorhynchus clarkia lewisi),* Interior Redband Trout *(Oncorynchus mykiss gairdneri),* Little Brown Bat *(Myotis lucifugus),* Western Bumble Bee *(Bombus occidentalis).*

Goal 3a: Ensure resilient, ecologically functioning aquatic habitats capable of supporting native aquatic species and their habitats within the Kootenai Basin.

Conservation Objectives

i. Conserve remaining functional blocks of streams and rivers supporting aquatic Priority Species.

ii. Restore functional blocks of impacted aquatic habitats capable of supporting native and Priority Species. Maintain and enhance the resiliency of these habitats.

iii. Promote connectivity between existing functional blocks of aquatic habitat within the Kootenai Basin.

iv. Identify and address threats to aquatic habitats and their surrounding terrestrial and riparian habitats to ensure aquatic integrity.

v. Protect and restore all aquatic habitat types (lakes, rivers, streams, and associated wetland and riparian areas) to ensure habitats for all life-history needs of aquatic Priority Species are available and connected.

Actions: 1, 2, 3, 4, 5, 6, 7, 8, 13 (see complete list of Actions below).

Goal 3b: Ensure abundant, diverse, and resilient populations of native Kootenai Basin species within their habitats.

Conservation Objectives

i. Protect or restore native habitats that support key life history components of Priority Species.

ii. Identify and address threats to aquatic Priority Species and their habitat.

iii. Promote connectivity between important aquatic habitat patches within the Kootenai Basin.

iv. Promote genetic diversity in the aquatic habitats.

v. Promote recovery of Priority Species.

Actions: 1, 2, 7, 8, 9, 10, 11, 12, 13, 14, 15 (see below).

Goal 3c: Ensure that aquatic habitats within the Kootenai Basin are connected to other aquatic systems within and adjacent to the Selkirk Cabinet-Yaak Priority Conservation Area.

Conservation Objectives

i. With partners, promote connectivity between important aquatic habitat patches within the Kootenai Basin.

ii. With partners, focus restoration and/or mitigation efforts on aquatic habitats that connect the Kootenai Basin to adjacent functional blocks of habitat within and outside of the Selkirk Cabinet-Yaak Priority Conservation Area.

Action: 10 (see below).

Conservation Actions for Selkirk Cabinet-Yaak Conservation Strategy 3:

Action 1: Protect and maintain prime, functioning tributary habitat.

Action 2: Restore and provide passage to migratory fish by removing human-created barriers, i.e. impassable culverts, hydraulic headcuts, water diversion blockages, landslides, and impassable deltas.

Action 3: Working with Action Agencies, bring Libby Dam operations closer to normal hydrograph conditions during summer and spring while providing flood control.

Action 4: Improve riparian function and complexity to levels that support or contribute to sustainable population levels of Priority Species.

Action 5: Improve channel complexity and habitat function within focal drainages.

Action 6: Establish a more normative mainstem thermal regime to be more within the tolerance range of all life stages of Priority Species and their prey.

Action 7: Incorporate climate adaptive planning when identifying key areas for conservation and restoration.

Action 8: Restore and enhance spawning and rearing habitat for Priority Species.

Action 9: Reduce threats from introduced species.

Action 10: Work with partners to maintain connectivity between the Kootenai Basin and important spawning stocks in British Columbia.

Action 11: Characterize, conserve, and monitor genetic diversity and gene flow among local populations of Priority Species, and maintain or increase the total number of genetically pure local populations.

Action 12: Maintain or increase the total number of identified local populations of Priority Species, and maintain the broad distribution of local populations across all existing core areas within recovery units.

Action 13: Work with Partners to create pollinator habitat and minimize the use of pesticides where practical.

Action 14: Work with partners and stakeholders to develop and implement a statewide strategic plan for white-nose syndrome (WNS), including protocols for surveillance and response to the introduction of WNS in Idaho.

Action 15: Assist our partners with conducting bat surveys, identifying summer roosts and winter hibernacula, and developing/implementing the North American Bat Monitoring Program (NABat)[13].

Conservation Strategy 4: Restore riparian and wetland habitats within the Selkirk Cabinet-Yaak Priority Conservation Area to ensure the continued persistence, health, and diversity of native species.

Priority Species: American Beaver *(Castor canadensis)*, Willow Flycatcher *(Empidonax traillii)*, Western Bumble Bee *(Bombus occidentalis)*, Northern Leopard Frog *(Rana pipiens)*.

Goal 4a: Ensure resilient, ecologically functioning riparian and wetland habitats capable of supporting native species and their habitats.

Conservation Objectives

i. Conserve and enhance remaining functional riparian and wetland habitats that support Priority Species.

ii. Restore large functional blocks of riparian and wetland habitats capable of supporting native and Priority Species. Maintain and enhance the resiliency of these habitats.

iii. Identify and address threats to riparian and wetland habitats and their surrounding terrestrial and aquatic habitats to ensure ecosystem integrity.

iv. Protect and restore all riparian and wetland habitat types (floodplain, vernal pool, peat, etc.) to ensure habitats for all life history needs of Priority Species are available and connected.

v. Protect mosaics of riparian and wetland habitat at multiple scales.

Actions: 1, 2, 3, 4, 5, 6, 10 (see complete list of Actions below).

Goal 4b: Ensure abundant, diverse, and resilient populations of native species within riparian and wetland habitats.

Conservation Objectives

i. Protect or restore riparian and wetland habitats that support key life history components of Priority Species.

ii. Identify and address threats to Priority Species and their habitats.

iii. Promote connectivity between important habitat patches for Priority Species.

iv. Promote genetic diversity of Priority Species within riparian and wetland habitats.

v. Promote recovery of Priority Species.

Actions: 5, 6, 7, 8, 9, 10 (see below).

Goal 4c: Ensure that riparian and wetland habitats within the Selkirk Cabinet-Yaak Priority Conservation Area are biologically connected to adjacent functional blocks of habitat.

Conservation Objectives

i. Identify existing and potential wildlife corridors that will provide connectivity for Priority Species.

ii. With partners, promote connectivity between important riparian and wetland habitat patches within the Selkirk Cabinet-Yaak Priority Conservation Area.

iii. With partners, focus restoration and/or mitigation efforts on habitats that connect functional blocks of riparian and wetland habitat within the Selkirk Cabinet-Yaak and adjacent areas.

Actions: 4, 9 (see below).

Conservation Actions for Selkirk Cabinet-Yaak Conservation Strategy 4:

Action 1: Work with partners to restore, protect, and enhance prime, functioning, and rare riparian and wetland habitats that support or contribute to sustainable population levels of Priority Species.

Action 2: Work with action agencies to reduce impacts to riparian and wetland habitat from development, agriculture, and hydrologic alteration.

Action 3: Reduce threats to riparian and wetland habitats by controlling for non-native species.

Action 4: Work with partners to reconnect functional blocks of riparian and wetland habitat.

Action 5: Restore and maintain the broad habitat diversity of riparian and wetland habitat types across the Selkirk Cabinet-Yaak Priority Conservation Area.

Action 6: Incorporate climate adaptive planning when identifying key areas for conservation and restoration.

Action 7: Work with partners to maintain or increase the distribution and abundance of Priority Species that utilize riparian and wetland habitats.

Action 8: Work with partners to implement standardized monitoring programs for Priority Species within riparian and wetland habitats.

Action 9: Work with partners in surrounding areas to ensure connectivity of riparian and wetland habitats that provide wildlife corridors between the Selkirk Cabinet-Yaak Priority Conservation Area and adjacent areas.

Action 10: Work with Partners to create pollinator habitat and minimize the use of pesticides where practical.

ENDNOTES

(NOTE: Endnotes are linked back to the pages where they appear in the document.)

1. Pertain to federal trust resources. *(p.2)*
2. See References: Fish and Wildlife Service 2014. *(p.2, p.3)*
3. For more on this approach go to: **http://www.fws.gov/landscape-conservation/shc.htm** *(p.3)*
4. Omernik and Griffith (2014) *(p.4)*
5. Referenced species lists includes: Fish and Wildlife Service 2008, Idaho Dept. Fish and Game 2005, Idaho Native Plant Society 2011, Forest Service 2011. See also Fish and Wildlife Service 2014. *(p.5)*
6. Both Westslope and Yellowstone Cutthroat subspecies are named independently, but they can be treated as a single species given their common habitat requirements and allopatric distribution within Idaho. *(p.7)*
7. White Sturgeon is a single species that includes the federally listed Kootenai Distinct Population Segment. *(p.8)*
8. Idaho Department of Fish and Game 2015 *(p.8)*
9. Fish and Wildlife Service (2010, 2015a, b) *(p.12)*
10. Fish and Wildlife Service 2000, 2007 *(p.14)*
11. Idaho Department of Fish and Game 2014 *(p.14)*
12. Bureau of Land Management 2015 *(p.18, p.19)*
13. Loeb et al. 2015 *(p.20, p.24, p.25, p.39, p.40)*
14. Keane et al. 2012. *(p.23, p.25)*
15. Fish and Wildlife Service 2015a, c *(p.25)*
16. May et al. 2007 *(p.25)*
17. Bureau of Land Management 2015 *(p.28, p.29)*
18. Idaho Deptepartment of Lands 2015 *(p.29)*

GLOSSARY OF KEY TERMS

(NOTE: Each term below is linked back to the page in the document where it first appears in the document.)

Conservation Actions: Specific actions that, when carried out, will result in on the ground conservation or inform future actions, that will support the stated Conservation Objectives for each of the Priority Conservation Areas. *(p.7)*

Conservation Objectives: General objectives based on accepted conservation principles that support IFWO's stated goals for each of the selected Priority Conservation Areas. These are broad objectives lacking quantifiable or stated measurable outcomes. *(p.7)*

Conservation Strategies: Individual plans developed by the IFWO Conservation Teams that outline conservation goals, conservation objectives, and a suite of Conservation Actions to address important conservation targets. *(p.4)*

Conservation Teams: Teams made up of IFWO staff assembled to identify and help implement conservation strategies within each of the Priority Conservation Areas. *(p.5)*

Ecological Integrity: The structure, composition, and function of an ecosystem operating within the bounds of natural or historic range of variation. *(p.3)*

Ecoregion Teams: Teams made up of IFWO staff assembled to identify important conservation landscapes within each of seven ecoregions found in Idaho (modified). Ecosystem Teams were disbanded after selection of four Priority Conservation Areas and replaced by Conservation Teams. See: Fish and Wildlife Service 2014. *(p.4)*

Iconic Species: Also referred to as "flagship species," is a concept that holds that by raising the profile of a specific charismatic species, it can successfully leverage more support for conservation of a habitat, region, ecosystem, or assemblage of other species. *(p.3)*

Indicator Species: A species whose presence, absence, or relative well-being in a given environment is a sign of the overall health of its ecosystem or a specific environmental condition. A species particularly sensitive to environmental conditions and therefore provide warnings/information on ecosystem or habitat health. *(p.3)*

Keystone Species: A species that has a disproportionately large effect on its environment relative to its abundance. Keystone species play a critical role in maintaining structure within a habitat type or ecological community, affecting numerous other organisms within it. *(p.3)*

Priority Conservation Areas: Large geographic areas inside of Idaho, determined by IFWO staff to be of elevated conservation value. Selection of Priority Conservation Areas was conducted to focus IFWO conservation efforts in an attempt to make coordinated and significant advances in achieving conservation goals and objectives on the ground. *(p.3)*

Priority Species: Native species identified by IFWO staff to serve as habitat icons, indicators, or umbrella species, or with significant ecosystem values, to be used to garner public support and/or as monitoring metrics as proxies for habitat or ecosystem health. *(p.3)*

Trust Resources: Those natural resources that are protected or regulated under federal law and hence under some level of jurisdiction by a federal entity or agency. Examples of federal trust resources include: species listed under the Endangered Species Act, migratory birds, interjurisdictional fish, and wetlands. The Service and other federal agencies also have trust responsibilities with native American Tribes. *(p.6)*

Umbrella Species: Terminology typically used in conservation applications; protecting the selected "umbrella species," through ecosystem or habitat protection, will indirectly protect numerous other species associated with that ecosystem or habitat. *(p.3)*

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Owyhee River © USFWS

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Attachment 2

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COMMENTS
OF AMERICAN WHITEWATER
REGARDING THE PRELIMNARY APPLICATION DOCUMENT AND REQUEST TO USE THE TRADITIONAL LICENSING PROCESS FOR THE FELT HYDROELECTRIC PROJECT, FERC PROJECT 5089

Submitted on: OCTOBER 15, 2018

American Whitewater is a national nonprofit organization dedicated to conserving and restoring our nations whitewater resources and to enhancing opportunities to enjoy them safely. Our members are primarily conservation-oriented non-commercial kayakers, canoeists, and rafters. We have significant membership in the vicinity of the project, and some of our members regularly enjoy paddling the reach of Teton River on which the Felt Project is located. One staff member has paddled the reach immediately downstream of the Project. Our interest in the Felt Project is in securing enhanced public access to the Teton River.

About the Teton River – Comments on the Preliminary Application Document

The Felt Project bisects two very different, outstanding, and relatively popular whitewater runs. These runs, which are often combined, flow through a deep scenic canyon, with pockets of lush forest, dry forest, and dramatic cliff bands. Paddlers in the canyon can scarcely fathom that feet from the canyon rim is an expansive flat agricultural landscape. The large drainage area grant the Teton a long recreation season that is treasures by local and traveling paddlers.

Above the Project is a classic challenging section of the Teton with numerous class IV and V rapids. This run is frequented by paddlers from Driggs, Victor, Idaho Falls, Jackson, and paddlers both more local and travellers from afar.

Upon reaching the Project, paddlers face a quandary. Paddlers have to exit the river upstream of the dam without the benefit of signage or trails and then negotiate numerous fences and project works to reach the access road. If taking out, paddlers have to then carry their boats 460 vertical feet up and out of the canyon on a 0.4-mile jeep trail to the parking area on the canyon rim. Many paddlers will portage the dam and Class VI rapid below it and paddle the high quality Class V portion of the bypassed reach known as the “Bone Yard” before hiking out. At this point the hike out is 0.6 miles and almost 600 vertical feet. If paddlers wish to continue downstream and also run the lower reach they portage the dam and the Class VI rapid immediately below and use access roads to put back in either: 1) right below the Class VI bend, or 2) just upstream of the second powerhouse where difficulty eases.

Below the Project is one class IV rapid that can be portaged near the mouth of Badger Creek, followed by a delightful series of five big water class III rapids reminiscent of the New River Gorge in West Virginia. The scenery and fishing in this reach are outstanding, and the run transports paddlers into a canyon that was briefly inundated beneath the reservoir of the ill-fated Teton Dam. Paddlers can still see the effects of the reservoir failure in hillside slumps which reportedly created the 5 big rapids and pools that define the canyon, but the canyon otherwise offers unbroken solitude and natural scenery. Some paddlers enter this reach via the Class IV+ Bitch Creek, with flows in from river right.

Accessing this lower reach is a chore. Paddlers not wishing to able to tackle the Class V upper Teton and the portage of the dam must carry their boats 0.6 miles and almost 600 vertical feet down from the parking area to the river near the powerhouse. While an option for able-bodied kayakers, this poses a near impossibility for rafters and significant challenges for everyone else. In fact, this option is so daunting that rafters negotiate a daunting "slide" further downstream where they lower their oar rigs with ropes from the canyon rim to the river.[1]

Our National Whitewater Inventory page for the Teton River is sparse at best, and we will work with local paddlers to update it with additional information. The Teton is also written up in Idaho the Whitewater State, by Grant Amaral.

We hope the above information can inform the recreation information included on page 19 of the PAD.

Use of the Traditional Licensing Process

American Whitewater does not object to the use of the Traditional Licensing Process for this Project.

Study and Protection, Mitigation, and Enhancement Measure Needs

River access and egress for paddlers is a significant issue associated with the Felt Project. We request that the Licensee complete a study of river access needs and opportunities, and consider enhancements. We feel that access is the limiting factor in public enjoyment of the Teton River, and the fencing and gates maintained by the Licensee needlessly impede foot travel and in other cases vehicular travel, and that the parking provided is too far from the river. The river access facilities provided, while appreciated, are not sufficient to support public use and enjoyment of the Teton River at the Project.

Specifically we ask that the Licensee study the options of:

---

[1] See: http://flyfishadventure.blogspot.com/2010/11/teton-river-slide.html. See Also: https://goo.gl/images/w75khH

1. Removing gate at the canyon rim, maintaining access road for passenger vehicle traffic, and constructing a simple new parking area relatively close to the river. See photo below for a suggestion of where parking could potentially be provided.

2. Providing portage / river access trails or clearly marked dedicated routes from upstream of the dam to the new parking area, and from near both powerhouses to the new parking area.
3. Removing the old gate at the old jeep road that is now a trail and replace that with boulders to prevent motorized vehicle access.
4. Removing fencing along the top of the trail and replace with signs that warn of any concerns or dangers.
5. Removing fencing near the rivers edge.

We recognize this request is being suggested early in the process, but we are sharing our interests in response to the PAD, in which the Licensee proposes no studies or changes to recreational protection, mitigation, and enhancement measures. We will participate in scoping, and hopefully have a representative at the upcoming scoping meetings.

Thank you for considering these comments.

Sincerely,

Kevin Colburn
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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Fall River Electric Cooperative Inc	)	Felt Hydroelectric Project
	)	Project No. 5089
	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated this 15th day of October 2018

Carla Miner

Carla Miner
American Whitewater
Stewardship Assistant

Service List for P-5089-000 Fall River Rural Electric Cooperative, Inc.

Contacts marked ** must be postal served

Party	Primary Person or Counsel of Record to be Served	Other Contact to be Served
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Attachment 3

FRIENDS OF THE teton river

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Felt Hydroelectric Project FERC No. P-5089
Study Requests from Friends of the Teton River
February 11, 2019

Introduction:

The Felt Hydroelectric facility was known to be a complete barrier to fish from the early 1900's until the mid-1980's (Figures 1-4) (IDFG, Schrader et al. 2002). It is quite likely that the migratory life history pattern of native Yellowstone cutthroat trout (YCT) between the Lower Teton River and the Upper Teton River disappeared during the decades that the Felt dam was a barrier to fish since the Teton River supports large fluvial YCT migrations from mainstem reaches up tributaries both upstream and downstream of Felt dam. Disruptions of migratory life history patterns due to dams and diversions are one of the factors leading to the decline of YCT and their resulting sensitive species designation by federal and multi-state wildlife agencies.

After a fish ladder was installed in 1986 on Felt Dam, several small studies were conducted to evaluate the success of the fish ladder but no studies have been conducted to determine the impacts the facility has had on YCT populations in the watershed, nor has there been any studies to assess the impacts the dam may be having on water quality or studies to determine recreational use at the facility. At this point in time, it is imperative that the studies requested in this document be initiated for the following reasons:

1) YCT are considered to be a conservation dependent species meaning, that without concerted conservation work to protect and maintain the species their numbers would most likely continue to decline across their range. The impact the Felt dam has had on the Teton River YCT population needs to be fully understood to determine if additional mitigation strategies need to be implemented.
2) We know significantly more about YCT migration; the Teton River Watershed YCT population; fish ladders; and fish screens than we did since the last studies were conducted on Felt dam 20 years ago.
3) New technologies have become available since the last Felt dam studies were conducted that can be used for studying trout movement; YCT source populations; and fish screen effectiveness at the Felt dam. These new technologies have been used extensively throughout the Teton River Watershed with documented success.

4) If the Felt dam has had the impact on YCT that is suspected by fisheries biologists based upon recent YCT studies, new technologies exist that can greatly improve fish passage and fish screening at the Felt dam site for relatively low costs.
5) IDEQ has listed the Teton River as temperature impaired. A large effort is taking place in the watershed to reduce stream temperatures and since nothing is known about the Felt dam facility's impact on stream temperature, a stream temperature study needs to be initiated to determine if mitigation strategies are necessary.
6) New opportunities exist to potentially increase base line flows at the Felt hydropower facility during low flow periods which could increase power production.
7) Recreational use at the Felt dam facility has not been studied and most likely has increased dramatically in recent years based upon the documented increase in use in the other Teton River sections.
8) It appears that the facility has been in non-compliance with a mitigation plan with Idaho Fish and Game (IDFG) and may be in non-compliance with a mitigation plan with the Army CORPS of Engineers (CORPS) and Environmental Protection Agency (EPA).

Commenting Organization Background:

Friends of the Teton River (FTR) is a non-profit based in Driggs, Idaho that works with our community and partners to develop place-based solutions that maintain the viability and health of our working lands and stream corridors, while protecting our water resources, improving water quality and stream flows, and restoring functioning fish and wildlife habitat in the Teton River Watershed. In 2003, FTR started working with partners to identify YCT conservation projects in the watershed after IDFG Teton River electro-fishing surveys showed a 95% decline in Upper Teton River YCT populations at established IDFG electro-fishing sites between 1999 and 2003. By 2005, FTR and partners began to implement large-scale YCT conservation projects which included habitat restoration projects and fish passage improvement projects. After fourteen years of implementing YCT conservation project, YCT densities have increased significantly in the Upper Teton River from 10 YCT/mile in 2003 to 495 YCT/mile in 2017 according to IDFG Teton River electro-fishing studies. Projects to improve conditions for YCT in and around Felt dam may be a critical component of this important work to maintain viable YCT populations in the Teton River Watershed and across the range of the species. The studies requested in this document will provide scientific data to inform potential YCT conservation projects. FTR is dedicated to working with agency and private partners to continue improving YCT populations in the watershed by implementing YCT conservation specific projects that have been identified by scientific research. FTR is dedicated to working with agency and private partners to develop, implement, and evaluate the studies requested in this document which FTR views as the highest priority studies in the watershed for YCT conservation. Since many of FTR's members are also members of Fall River Rural Electric Cooperative (FRE) we see the potential for a win-win collaboration between the organizations to improve conditions for fish; improve water quality; and increase power production during low flow periods.

(i) Identify the Requested Studies:

The Requested Studies are designed to evaluate the effects of the Felt Hydropower plant on YCT and water quality. The studies will also identify potential sources of water to increase base flows delivered to the facility; and evaluate recreational use at the facility. All of the requested studies can be completed for relatively low costs due to the cost effectiveness of new technologies that would be used for the studies. The studies requested in this document were developed through a collaborative effort between IDFG, Idaho Department of Environmental Quality (IDEQ), Wyoming Game and Fish (WYGF), US Forest Service (USFS), BLM, FTR, Trout Unlimited (TU) and Greater Yellowstone Coalition (GYC).

The Requested Studies include the following:

1) Determine the effectiveness of the fish ladder in promoting migration of YCT greater than 12 inches. Determine if fish moving upstream are delayed or unable to find the entrance to the ladder due to insufficient attractant flows. If it is not effective, changes may need to be made to increase passage of YCT. Since the fish ladder has not been studied since 1999 it is unknown if trout utilization of the ladder has changed in the past two decades. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.
2) Determine if any of the facility components including but not limited to the pool, spillway, ladder, screens, and/or turbines are currently serving as barriers to downstream migration of fish. If any of these components of the facility are a barrier, this may be having a positive impact on YCT since it may help to reduce the movement of non-native fish populations into the Teton River Canyon section from upstream, however it may also be isolating Upper Teton River YCT from Teton River Canyon YCT. If issues are identified, develop a list of alternative mitigation strategies and associated costs that would allow YCT migration in both directions and prevent non-native trout migration.
3) Determine the effectiveness of the intake fish screens. Determine the size of fish that are likely entrained in the intake pipes. Determine the turbine mortality rates based upon turbine type, head and etc. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.
4) Determine how fish use the bypass reach. Little is known about fish usage or passage through the bypass reach. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.
5) Assess water quality concerns, in particular the effects the facility may be having on stream temperature and dissolved oxygen. Teton River is 303d listed as impaired for temperature throughout its length so it is critical to determine if the facility is increasing temperature. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.
6) Assess the opportunity for FTR to work with FRE to increase base flows delivered to the facility.

7) Assess the level of recreational use at the facility and how this use influences recreational use in the Teton River Canyon area. Identify recreational impacts.
8) Assess all mitigation requirements and compliance with the requirements including but not limited to the following: resource mitigation agreement with IDFG; and mitigation agreement for a violation of the Clean Water Act with CORPS and EPA.

The following study methodologies could be used to evaluate each of the Requested Studies listed above:

To study the effectiveness of the fish ladder to pass YCT>12", fish located upstream and downstream of the ladder would be captured using electro-fishing equipment and hook and line gear and then each fish would be Passive Integrated Transponder (PIT)-tagged. PIT-tag antennas (Interrogation Sites) would be installed near the bottom of the fish ladder, in the fish ladder and on top of the dam and would be used to monitor fish movement. YCT captured upstream of the fish ladder would be transported downstream of the dam to study if they use the fish ladder to return to their place of capture. Attractive flow versus the location of the ladder entrance would be studied to determine if these factors are affecting migrating YCT. This study would be conducted over a period of at least 2 seasons. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.

To determine if the facility is currently serving as a barrier to downstream migration of fish, trout up stream of the facility would be PIT-tagged. In addition to analyzing PIT-tag data from the fish ladder, trout would then be recaptured using electro-fishing and hook and line gear to determine movement. Screw traps would also be placed upstream and downstream of the dam to capture juvenile and adult trout movement. Genetic material from YCT captured upstream from the dam between the dam and River Rim would be collected and analyzed to determine if YCT located in this reach are more closely related to Upper Teton River YCT or Teton River Canyon YCT. This study would be conducted over a period of at least 2 seasons. Develop a list of alternative mitigation strategies and associated costs that would allow YCT migration in both directions and prevent non-native trout migration.

To determine how fish use the bypass reach, electro-fishing and hook and line gear would be used to capture trout in the bypass reach during different seasons. Trout species abundance, composition and size classification would be determined during capture efforts. Redd surveys would also be conducted in the spring when possible to determine if the reach is used for spawning. An R1/R4 habitat survey would be conducted to determine the quality and quantity of fish habitat in the reach. This study would be conducted over a period of at least 2 years. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.

To determine the effectiveness of the intake screens in screening fish, flow meters and underwater cameras would be used to evaluate approach velocities and impacts on fish for different flow levels and when juvenile trout are migrating. The migration timing would be determined by information collected from the screw traps. This study would be conducted over a period of at least 2 seasons. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.

To assess water quality concerns, in particular the impacts the facility may be having on stream temperature, new temperature loggers would be placed directly downstream of the dam impoundment; in the by-pass reach; at the downstream end of the by-pass reach; and in the tailwater reach upstream of the Badger Creek confluence. Information from these loggers would be compared to the existing temperature logger located upstream from the Felt dam pool to study the impacts of the Felt hydropower operation on stream temperature. This study would be conducted over a period of at least 2 years following installation of the loggers. If issues are identified, develop a list of alternative mitigation strategies and associated cost estimates.

To assess the opportunity for FTR to work with FRE to increase base flows delivered to the facility FTR and FRE would meet to determine if FTR and partners can provide enough flow at the appropriate time to increase power generation. FTR is currently working on projects designed to increase base flows in the Teton River which could provide increase base flows to the facility. FTR has recently partnered with Henry's Fork Foundation to install a flow gage at an old USGS flow gage site (Narrows Screw Trap Site in Figure 5) in order to measure flow in Teton River below all Upper Teton River diversions. Information from this new gage could be used to help study a potential increase in base flows delivered to the facility. This study may play a role in FRE's decision to repair Powerhouse #1. This study would be conducted over a period of a year.

Assess the recreational use the facility currently provides the public and how this use affects the Teton River Canyon area. Discuss the impacts that increased use could have on the facility and the Teton River Canyon area and what mitigation planning and implementation may be needed to manage recreational use of the facility.

The mitigation plans that were finalized with IDFG and the CORPS/EPA would be reviewed to assess compliance with the plans.

(ii) Identify the Basis for the Requested Studies:

At this time, little is known about the impacts the Felt dam has had on Teton River YCT and water quality. The following is discussion of what we know to date concerning the dam and the section of Teton River where the dam is located.

Felt dam was known to be a complete barrier to fish from the early 1900's until 1986 when a fish ladder was in installed. According to several Teton River trout movement studies, there are currently very few trout that move between the three sections of Teton River (Upper, Canyon and Lower) which are separated by the Felt dam and the Wilford Diversion dam (Figure 1). This data indicates a loss of the potentially large historic fluvial YCT migration that most likely existed in the Felt dam reach. In the 80's and 90's, a fish trap was used to study trout movement at the Felt dam fish ladder and a screw trap was used to study fish movement upstream from Felt dam. Between 1987 and 1988 tagged fish were trapped moving through the new Felt dam fish ladder but no significant movement was recorded (ERI 1987, 1988). FTR and IDFG attempted to find these reports but we were unable to locate them so we don't know how many trout or what species used the ladder. In 1998 starting on April 30 to the end of the season and in 1999 from March 29 to June 5, IDFG operated a fish trap on the Felt dam fish ladder and recorded the upstream migration of 16 adult trout using the ladder (13 rainbows and 3 YCT). In 1998 and 1999 IDFG tracked the movement of 8 Teton River Canyon trout implanted with telemetry-tags (5 YCT and 3 hybrids) and none of them moved upstream of Felt dam. In 2015 and 2016, FTR tracked the movement of 64 rainbows and hybrids that were telemetry tagged in Bitch Creek and in Teton River Canyon and none of them moved up stream of Felt dam. In 1998, IDFG operated the Narrows screw trap at the old USGS station located downstream from Highway 33 (6.25 miles upstream from Felt Dam) and captured 57 YCT averaging 81mm (Figure 5). Most of these YCT were juveniles possibly migrating downstream towards Felt dam. During the same study, IDFG captured 24 rainbows averaging 93mm most of these rainbows were also juveniles possibly migrating downstream towards Felt dam.

Several fish population studies have been conducted near Felt dam. A 2013 IDFG electro-fishing study of the Harrops Site located between Highway 33 and River Rim found that rainbow trout made up 97% of the species composition however the extent of this composition is unknown but assumed to extend to Felt dam according to anecdotal information (Figure 5). A FTR hook and line survey conducted just downstream of Felt dam on 10/28/2013 found 89% rainbows and 11% YCT. In 2016, a FTR hook and line survey from the Felt dam turbine outlet to the Bitch Creek confluence found 57% rainbows/hybrids and 43% YCT. Several hook and line surveys and IDFG electro-fishing data at their Teton River Parkinson Site have found the trout composition to be approximately 15% rainbow/hybrids and 85% YCT in the Teton River Canyon between Spring Hollow and the Teton dam site. The surveys show that the composition changes from rainbow dominance to YCT dominance in a downstream direction from Felt dam. It is unknown why rainbows are the dominant species near Felt dam. It could be due to a rainbow source population upstream from the dam; due to the rainbow source population located in the lower perennial section of Badger Creek which is estimated to be 12,000 rainbows; or it could be related to temperature and hydrology conditions near the dam that may be benefiting rainbows more than YCT. It seems likely that the Lower Badger Creek rainbow population is the source of these rainbows since this population is less than a mile downstream from Felt dam. If Badger Creek is the source of rainbows near the Felt dam then it is possible that the dam impoundment may be limiting downstream movement of rainbows from the reach upstream of the dam.

Little is known about the habitat in the section of Teton River between River Rim and Felt dam due to difficult access, however the four Class V rapids located in this section are not considered to be barriers for fish passage according to local boaters. The large rapid in the bypass reach between the Felt dam and the turbine outlet is considered to be a Class VI rapid but is not considered to be a barrier to fish passage however this hasn't been studied.

It is possible, based on our currently knowledge, that the Felt dam has helped to keep rainbows from the Upper Teton River section out of the Teton River Canyon section. It is also possible that the fish ladder at Felt dam may be underperforming and may need to be modified or replaced. It also seems possible that thousands of YCT historically migrated through this section of Teton River to the upper watershed to spawn based on YCT movement studies and that this run ended when the Felt dam was constructed in the early 1900's.

A current study being conducted by the IDFG genetics lab to determine YCT source populations in the Teton River could help determine how the Felt dam has affected Teton River YCT populations. The preliminary results of this study suggest that there is a detectable genetic separation between YCT populations located in the Upper Teton River and the Teton River Canyon sections. If there is a separation between these two populations the split likely occurs at Felt dam but this has yet to be determined since very little is known about the YCT population between Felt dam and River Rim. The final results of the IDFG source population study is scheduled to be released in March, 2019.

The impact of the Felt dam impoundment on stream temperature is unknown. Also, it is unknown how temperature in the bypass reach is affected by the operation of the hydropower facility. Figure 7 shows the difference in temperature between temperature loggers placed upstream from the Felt dam pool (Felt Dam Site) and just upstream from Spring Hollow (Spring Hollow Site). It is not clear what impact Badger and Bitch creeks play on the differences in temperature shown on the graph.

The Felt hydropower facility is easily accessed by foot by recreational users. The trend in recreational use is unknown at this time and has most likely increase dramatically in recent years based upon the documented increase in use in the other sections of Teton River.

(iii) Understanding the Resource Issues and Goals and Objectives for the Resources

The goal of the requested studies is to evaluate the impacts the Felt hydropower facility may be having on YCT and Teton River water quality and to identify mitigation strategies if impacts are determined; to identify the potential to increase baseline flows at the facility; to assess the recreational use at the facility; and to assess compliance with mitigation plans. The objectives of the studies are to:

1) Determine if the fish ladder is limiting YCT migration.
2) Determine if the facility is limiting downstream migration of fish.
3) Determine if the intake screens effectively screen fish and what size fish the screens prevent from becoming entrained in the intake pipes.
4) Determine if fish use the bypass reach during different seasons.
5) Assess the impacts the facility may be having on stream temperature.
6) Assess the opportunity for FTR to work with FRE to increase base flows delivered to the facility.
7) Assess the current level of recreational use at the facility and how this use affects the Teton River Canyon area.

8) Assess compliance with mitigation plans.

YCT without signs of introgression only occupy 17% of their historic range and many of the remaining YCT stronghold populations are considered to be at risk due to non-native competition and introgression; loss in habitat; and climate change impacts (May et al. 2003). In the mid-2000’s, YCT were petitioned for an endangered species listing which was declined by the USFWS but the possibility of listing started a large concerted effort to protect remaining YCT populations and improve YCT populations through the implementation of prioritized YCT conservation projects. The studies requested in this document will help to assess if there are any factors associated with the Felt dam that limit YCT abundance and distribution in the Teton River Watershed. If limiting factors are identified, the requested studies will help to identify potential mitigation strategies. If the dam has prevented large YCT migrations to and from spawning areas as suspected, the goal would be to improve passage conditions at the dam to reestablish the historic migration which could be very important for the survival of the species.

Water quality is a concern since Teton River is 303d listed as temperature impaired. The temperature study requested in this document will determine how the facility is affecting stream temperature and will help to identify possible mitigation strategies if it is determined that the facility is contributing to elevating Teton River stream temperatures.

The potential to increase base flows at the facility from water management programs that are being implemented by FTR and partners in the Upper Teton River Watershed is unknown at this time. The study requested in this document will help identify how water management in the upper portion of the watershed may increase power production at Felt dam. Information from this study could help inform FRE’s decision to rehabilitate Powerhouse #1.

The recreational use of the Felt hydropower facility is unknown. The study requested in this document will provide managers with information on current recreational use and help them plan for future recreational use.

(iv) Study Methodology Alternatives

The studies requested in this document were developed through a collaborative effort between IDFG, IDEQ, WYGF, USFS, BLM, FTR, TU and GYC. The methodologies for each study discussed in this document were developed by experts from each of these organizations. These experts have used the methods described in this document and consider these methods to be the most appropriate alternative for each study.

(v) Proposed Study Methodologies and Standard Practices:

All of the above described methods are industry standard practices. For any studies that FTR is involved in, FTR consults with members of the Teton River Science Review Committee to ensure that study design and methods are held to the highest standards. The Committee consists of members of state and federal agencies, trout research scientists and regional NGO’s. The studies requested in this document will complement extensive, cutting edge monitoring of the watershed which started in 1987 when IDFG established the first long-term trout population monitoring sites on the Teton River and now covers the entire watershed and includes trout population, hydrology, water quality, and stream temperature monitoring sites (Figure 6). The same methods that have been successfully used to monitor the watershed to date will be applied to the requested studies.

(vi) Usefulness of Proposed Studies:

The requested studies combined with on-going watershed monitoring will fill-in current data gaps and questions surrounding the Felt hydropower facility and help identify what, if any, issues need to be resolved. In the event that mitigation measures are needed at the facility as currently suspected, the studies will help identify appropriate mitigation projects and costs. If mitigation projects are identified and implemented, the studies will also help to evaluate the efficacy of any project work that is implemented.

Only handful of studies have ever been completed on Felt dam and between what we have learned since those studies were conducted and with the monitoring technologies now available, the opportunity currently exists to extensively and cost effectively study the dam. Based upon recent Teton River and regional YCT studies, the dam has most likely had profound effects on YCT both good and detrimental: potentially good by slowing down non-native rainbow invasion from upstream and potentially detrimental by inhibiting passage of thousands of migrating YCT moving in both directions. The expert consensus is that, based upon YCT life-history strategies, it is completely conceivable that historically core fluvial YCT populations from the Henry's Fork, Lower Teton River and Teton River Canyon would have utilized the abundant spawning habitat in the Upper Teton River tributaries. YCT from the Canyon are currently utilizing the tributaries available to them which includes Bitch and Canyon creeks. FTR estimates that the YCT spawning run in Bitch Creek consists of at least 4,000 fluvial YCT which is the only tributary to the Teton River Canyon which isn't flow limited due to diversions. Considering the abundance of spawning habitat in the Upper Teton River and the relatively short distance YCT would have had to migrate to access this habitat it is most likely that thousands of YCT would have migrated through the Felt dam reach prior to construction of the dam in the early 1900's. Not only is access to spawning areas critical for the persistence of YCT, ensuring that YCT have access to cold water refugia in the Upper Teton River is imperative for mitigating the effects of climate change including increased stream temperatures. We feel that a fish passage study at the dam is critical to determine if passage of YCT is limited by the dam and associated operation of the facility. In the event of a endanger species listing of YCT, passage at Felt dam will be closely scrutinized so we feel that studying passage before a listing occurs is important to show that everything is being done to pass as many YCT as feasibly possible. The studies requested in this document will be critical to informing what may have happened to migrating YCT in this reach and to reestablishing potentially critical passage for a species of concern. The timing of the studies proposed is appropriate and needed due to the need for informed YCT conservation work and the recent development of new, cost effective monitoring tools that can be used for the proposed studies.

It is also worth noting that new technologies exist that can greatly improve fish passage and fish screening at dam sites for relatively low costs. These types of projects could significantly improve passage for YCT in both directions; reduce downstream passage of non-native trout; and could help reduce any issues with the existing fish screens. These new technologies include step-pool fish ladders and electric fish guidance systems.

With FTR's involvement in groundwater recharge efforts in the Upper Teton River Watershed there may be opportunity to deliver higher base flows to the Felt hydropower facility which may provide FRE with an opportunity to increase power generation at the facility and may weigh in on their decision to rehabilitate Powerhouse #1.

FTR sees the requested studies as the first step forward in a win-win scenario for all project partners that will ensure that everything is being done to conserve YCT and improve water quality while improving dam operations by potentially increasing power generation. For FTR, the studies requested in this document are the highest priority YCT conservation studies in the watershed and we are dedicated to helping with the implementation, management and evaluation of these important studies in an efficient and timely manner. Information provided by the requested studies will be invaluable for making informed decisions for the management of YCT in and around the Felt dam and in the watershed.

Figure 1. Felt Dam Location and Teton River Sections

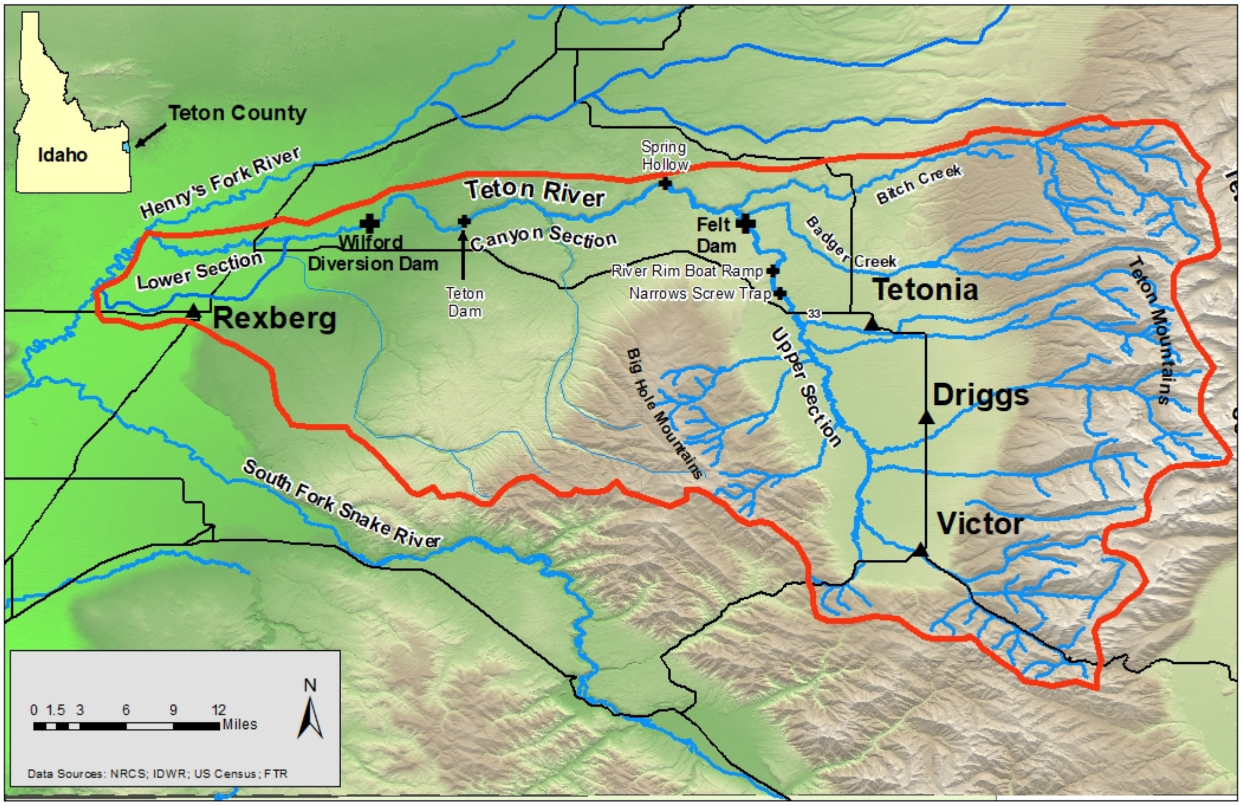


Figure 2. Felt Dam, Note: Fish Ladder on Left Side of Photo

Figure 3. Felt Dam Pool

Figure 4. Bypass Reach Downstream of Dam

Figure 5. Monitoring Sites near Felt Dam

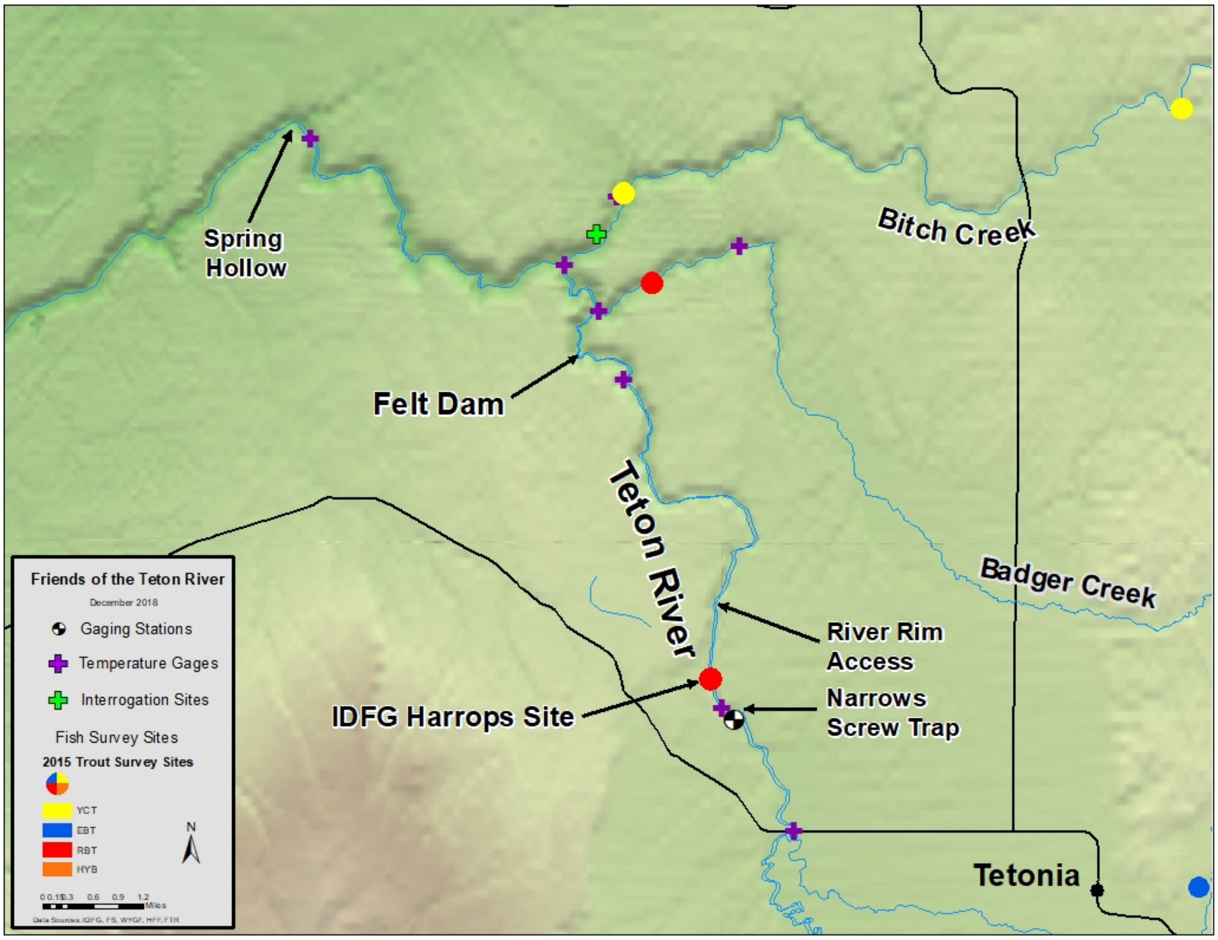


Figure 6. Monitoring Sites in Teton River Watershed

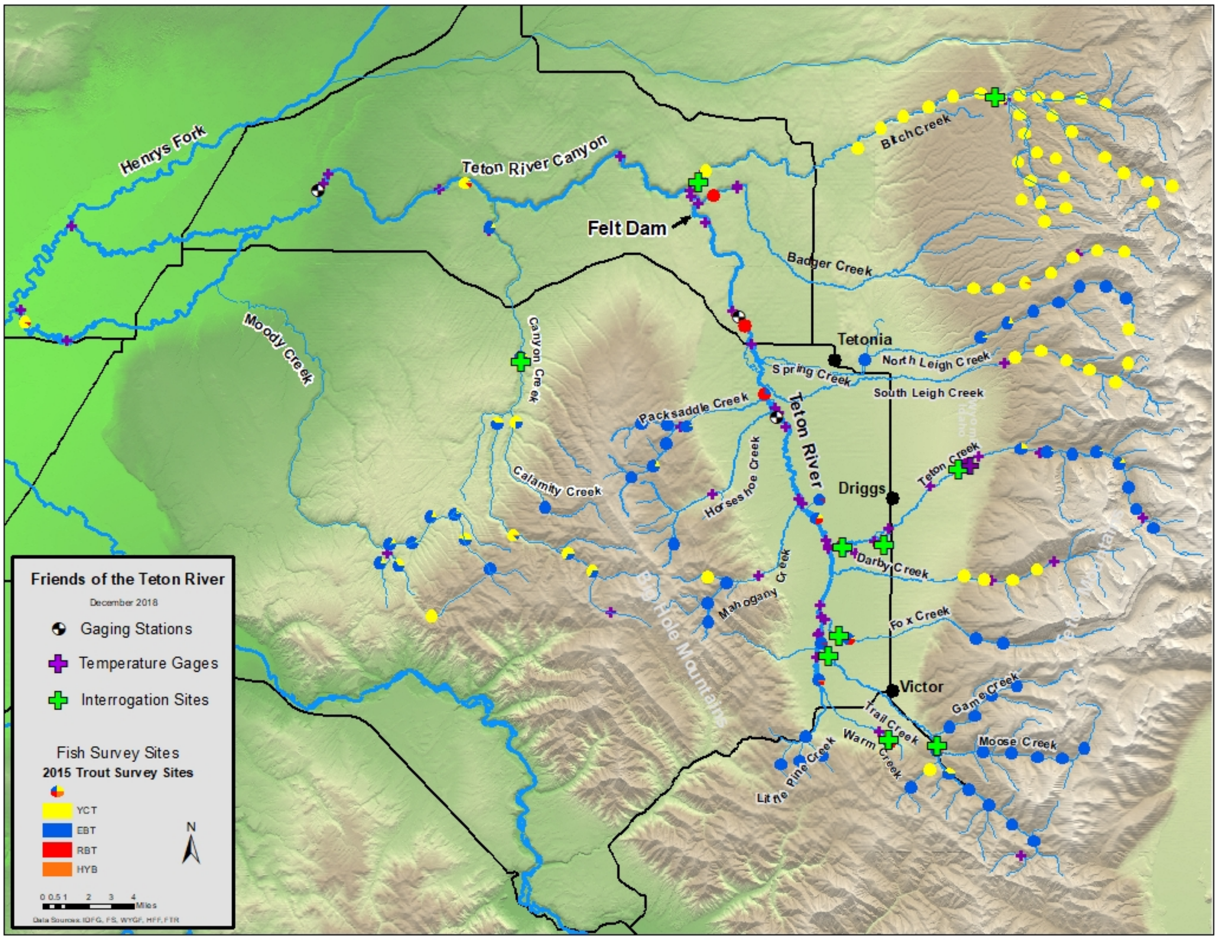
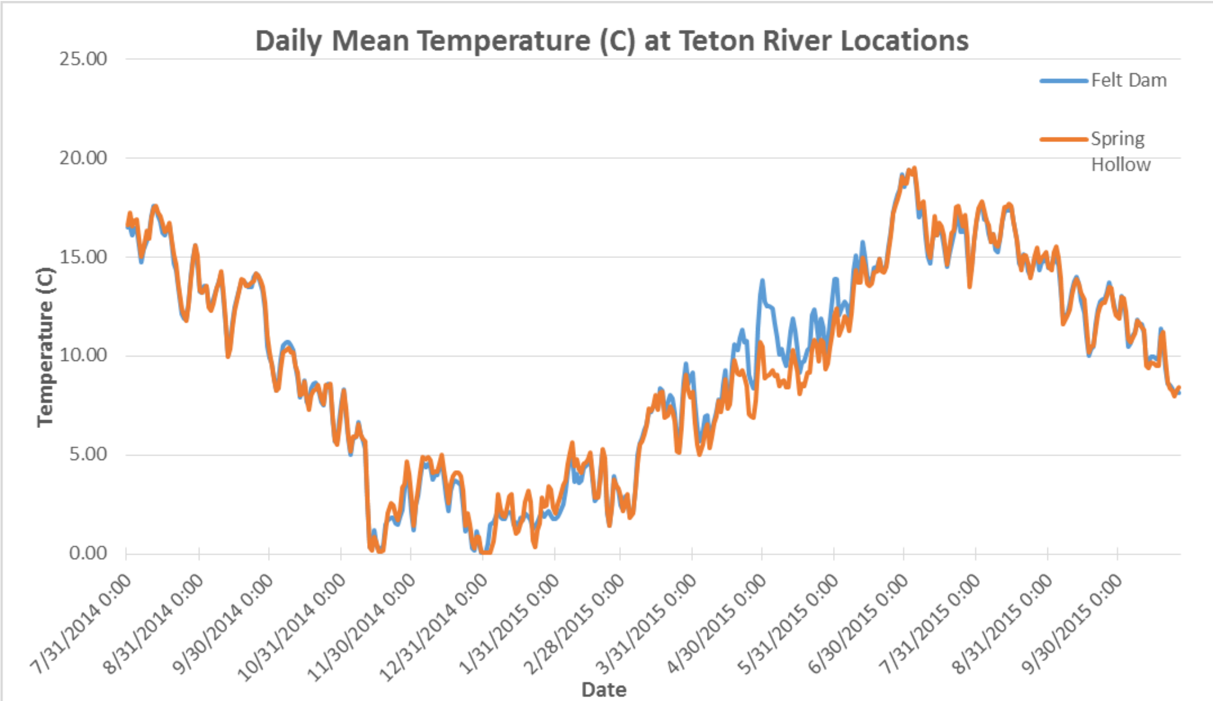


Figure 7. Comparison of Stream Temperature Between Loggers Placed Upstream from the Felt Dam Pool (Felt Dam) and just Upstream from Spring Hollow



Attachment 4

Status and Conservation of Yellowstone Cutthroat Trout in the Greater Yellowstone Area

7 authors, including:

Robert Al-Chokhachy
United States Geological Survey
77 PUBLICATIONS 1,330 CITATIONS

Bradley Shepard
Montana State University
52 PUBLICATIONS 1,404 CITATIONS

Jason C. Burckhardt
Wyoming Game and Fish Department
10 PUBLICATIONS 66 CITATIONS

Todd M. Koel
National Park Service
102 PUBLICATIONS 1,135 CITATIONS

Status & Conservation of Yellowstone Cutthroat Trout in the Greater Yellowstone Area

Robert Al-Chokhachy, Bradley B. Shepard, Jason C. Burckhardt, Scott Opitz, Dan Garren, Todd M. Koel, & M. Lee Nelson

Yellowstone cutthroat trout are native to the Greater Yellowstone Ecosystem (GYE) and surrounding drainages, including the Yellowstone River, Snake River, and Two Ocean Pass that facilitate connectivity between these drainages (Behnke and Tomelleri 2002; figure 1). Despite some differences in physical appearance between fine-spotted cutthroat trout, typically found in the Snake River, and "large-spot," found across much of the range, there has been no evidence of genetic distinction between these two groups of Yellowstone cutthroat trout (Novak et al. 2004).

Yellowstone cutthroat trout live in a variety of habitats, including small headwater streams, large rivers (e.g., Yellowstone and South Fork of the Snake rivers), and lakes, each demonstrating multiple life-history forms (Gresswell 2011). These trout are a key component of native communities as a food resource for several species (see "Birds and Mammals that Consume Yellowstone Cutthroat Trout," this issue). Indeed, changes in Yellowstone cutthroat trout abundance can have cascading effects on ecosystems (see "Non-native Lake Trout Induce Cascading Changes in the Yellowstone Lake Ecosystem," this issue). Yellowstone cutthroat trout also embody an important cultural and economic role through angling for many communities in the area (Gresswell and Liss 1995).

There have been significant declines in Yellowstone cutthroat trout distribution (figure 1) and abundance, with only 43% of their historic range currently occupied (Endicott et al. 2016). Losses of Yellowstone cutthroat trout have largely been attributed to habitat destruction and fragmentation, non-native species, and overharvest (Gresswell 2011). Only 23% of the current distribution of Yellowstone cutthroat trout is genetically unaltered (i.e., pure), with losses of genetic integrity largely due to hybridization with non-native rainbow trout (Campbell et al. 2002). However, recent assessments indicate the distribution of Yellowstone cutthroat trout has remained relatively stable over the past decade (Endicott et al. 2016). Coordinated efforts of fisheries managers through the Multistate Interagency Yellowstone Cutthroat Trout Conservation Work Group (May et al. 2007) are likely responsible for stemming declines in distribution observed during earlier decades.

Threats and Conservation Actions to Combat Threats

The severity of threats to populations of Yellowstone cutthroat trout have changed recently, and these changes are likely to continue into the future. Overharvest has been greatly reduced through angling regulations and changes in angler behavior (Cooke and Schramm 2007). As a result, current threats are primarily related to non-native species, habitat limitations, and climate change.

Non-native species—These are one of the greatest threats across the current range of Yellowstone cutthroat trout (Gresswell 2011). Species including rainbow trout, brook trout, and brown trout were extensively introduced as sport fish. While populations of some non-native species are socioeconomically important resources to many communities, they can threaten Yellowstone cutthroat trout populations through predation, competition, and hybridization (Campbell et al. 2002, Peterson et al. 2004, Seiler and Keeley 2007). Recent studies indicate the distribution and abundance of non-native species are increasing through time (Meyer et al. 2014). Streams accessible to these non-native species, even in some of the most pristine locations

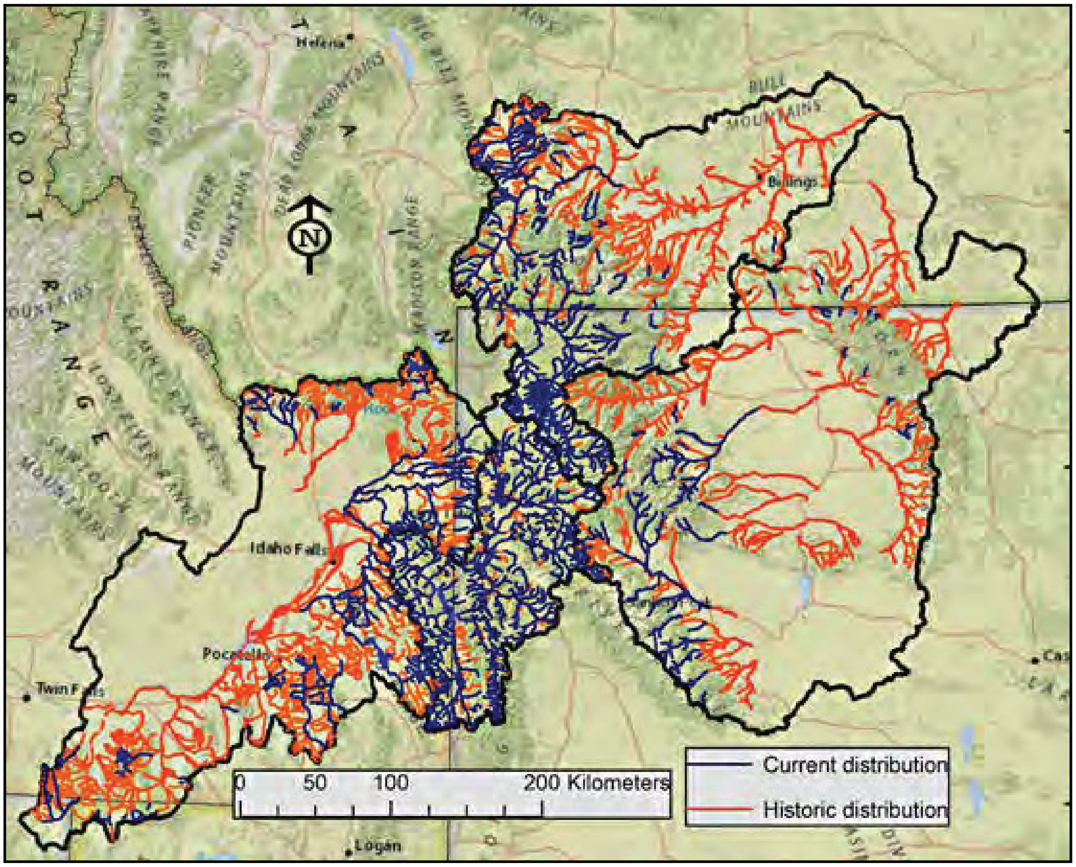


Figure 1. The historic and current distribution of Yellowstone cutthroat trout within the Greater Yellowstone Area in Montana, Wyoming, Idaho, Utah, and Nevada.

like the Lamar River in Yellowstone National Park, are being invaded by non-native species such as rainbow trout. Changes in non-native fish distributions and the effects of these non-native species on Yellowstone cutthroat trout will likely be exacerbated by climate change (Al-Chokhachy et al. 2013).

Fisheries managers have implemented a variety of conservation tools across the range of Yellowstone cutthroat trout to combat non-native species and enhance the persistence of existing populations. Tools include using fish toxins (piscicides) and mechanical methods (e.g., electrofishing) to remove non-native species in streams, erecting barriers to prevent invasions by non-natives, creating angler incentives to harvest non-natives, altering releases at hydropower dams to limit non-native spawning recruitment, and implementing intensive netting programs to reduce populations of lake trout. For example, Idaho Fish and Game recently implemented an incentive program to encourage anglers to harvest non-native rainbow trout in order to reduce their abundance in the South Fork of the Snake River. Similarly, Yellowstone National Park recently altered angling regulations to align with native fish conservation goals. Other approaches, such as the use of barriers that isolate populations from non-natives but also fragment cutthroat populations, represent a necessary paradigm in fisheries (Peterson et al. 2008). Often such programs are socially challenging and costly, yet may be necessary due to recent invasions by non-native species and their effects on Yellowstone cutthroat trout (Kruse et al. 2000).

Habitat—Degradation and fragmentation of habitat continue to be factors limiting Yellowstone cutthroat trout populations in some areas. Degradation has occurred to varying extents from land use, habitat alteration, and water diversions. Over the past 20 years, a substantial amount of habitat has been restored by state and federal agencies and non-governmental organizations (e.g., Friends of the Teton River, Henry's Fork Foundation, Trout Unlimited; Williams et al. 2015). Projects that improve fish passage, limit entrainment into irrigation systems, prevent invasion of non-native species, and restore stream channels and riparian habitat have been implemented across the range of Yellowstone cutthroat trout (figure 2). Despite such efforts, there continue to be abundant opportunities for additional restoration projects in areas currently occupied by Yellowstone cutthroat trout and in historically occupied areas where reintroductions may be feasible.

Climate change—Recent and future changes in climatic conditions have and are expected to substantially alter aquatic communities in the GYE and surrounding areas (Shepard et al. 2016). Cutthroat trout have relatively narrow thermal tolerances (Bear et al. 2007), and migration timing and life-history expressions are strongly tied to thermal and hydrologic regimes (DeRito et al. 2010). Warming summer temperatures coupled with changes in the magnitude and timing of precipitation and snowmelt runoff are likely to create more stressful summer conditions for Yellowstone cutthroat trout in some areas (Uthe et al., in review). As stream temperatures warm, the amount of thermally suitable habitat for Yellowstone cutthroat trout may be reduced considerably in some populations (Al-Chokhachy et al. 2013, Isaak et al. 2015). Lake-dwelling populations will also be affected by climate change because they rely on adequate connectivity to tributary streams (Kaeding 2010). In addition to the direct effects of changing thermal regimes, Yellowstone cutthroat trout are likely to become increasingly exposed to diseases in streams where temperatures warm dramatically (Koel et al. 2006) and suffer increased mortality from catch-and-release angling

Figure 2. An example of restoration activity conducted by Friends of the Teton River (Driggs, Idaho) to improve nearly 2 km (1.2 mi.) of habitat for Yellowstone cutthroat trout in Teton Creek, Idaho (PHOTOS - M. LIEN, FRIENDS OF THE TETON RIVER).

(Cooke and Schramm 2007). Most fish managers in the region restrict opportunities for angling when water temperatures reach critical levels, and these restrictions will likely become more frequent as the climate warms. Such restrictions may affect visitation to the Yellowstone area because angling is often an important component of tourism.

Future Conservation of Yellowstone Cutthroat Trout

Significant efforts are being made to maintain and enhance the existing distribution of Yellowstone cutthroat trout and stem the tide of historic losses. Fortunately, large networks of Yellowstone cutthroat trout populations still exist, particularly within the Yellowstone, the Upper Snake, and Lower Snake rivers (Endicott et al. 2016). The vast expanses of public land at relatively high elevations, including Yellowstone and Grand Teton national parks, can and will likely continue to support cold water habitats that make up the core areas of the Yellowstone cutthroat trout. Populations outside these large lake and river networks vary in size. While populations occupying larger, connected stream networks are likely more resilient (Morita et al. 2009), small populations of Yellowstone cutthroat trout also can have high resiliency (e.g., Peterson et al. 2014). Furthermore, geographically distinct populations (e.g., Camas Creek drainage, lower Bighorn drainage, and the Snake River near the Idaho/Utah border; Haak et al. 2010) are likely to represent areas of key genetic diversity that facilitate the long-term persistence of the species.

The extent and severity of current (e.g., non-natives) and future (e.g., climate change) threats to Yellowstone cutthroat trout populations suggest it will become increasingly important to address these concerns and secure populations. The relatively broad distribution of Yellowstone cutthroat trout suggests the importance in developing effective and coordinated conservation strategies (Williams et al. 2015), particularly as resource constraints often predicate the need to prioritize conservation actions (Lynch and Taylor 2010). With respect to climate change, this may involve identifying habitats that are most resilient to climatic shifts, both within the current distribution and where Yellowstone cutthroat trout were historically located to target population reintroductions. For example, populations with considerable groundwater inputs or those with access to deep, thermally stratified lakes (e.g., Yellowstone and Jackson lakes) are likely to be particularly resilient to climatic shifts.

Continued threats by non-native species will require expanding the tools to cost-effectively reduce or eliminate their threat to important Yellowstone cutthroat trout populations. We need to increase public support for dealing with these threats through improved communication with the public of how non-native species and illegal introductions threaten populations of Yellowstone cutthroat trout. Concomitantly, it will be important to consider novel approaches to control non-native populations, particularly given the high costs and efforts often needed to successfully reduce and/or remove non-native species.

Merging information regarding climatic resilience with existing non-native threats to populations can provide an overall framework for considering the urgency of conservation and management actions. For example, restoring habitat or removing a non-native species in an area with high climatic resilience may be given a higher priority for funding conservation actions than other areas that may be more sensitive to future climatic changes (Lynch and Taylor 2010). Decisions to implement particular conservation actions might be made through a hierarchical framework that considers potential conservation opportunities at range-wide, regional, and local scales, in terms of financial support and the ecological importance of specific populations. Within this framework, coordinating efforts across public and private entities to conserve and restore Yellowstone cutthroat trout populations will become increasingly important in the future, as both our human footprint and conservation needs grow.

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Robert Al-Chokhachy is a Research Fisheries Biologist with the USGS Northern Rocky Mountain Science Center in Bozeman, MT. Robert received a PhD in aquatic ecology from Utah State University in 2006 and conducted postdoctoral research related to threatened and endangered salmonids before joining the USGS in 2010. His current research aims to provide information for effective management and conservation of aquatic ecosystems. Since moving to Bozeman, a large component of his research has focused on the ecology, management, and conservation of Yellowstone cutthroat trout, particularly in the context of climate change.

Attachment 5

IDAHO DEPARTMENT OF FISH AND GAME
600 S Walnut / P.O. Box 25
Boise, Idaho 83707

C.L. "Butch" Otter / Governor
Virgil Moore / Director

January 10th, 2018

MEMORANDUM

To: Dan Garren and Brett High: Idaho Department of Fish and Game; Mike Lein: Friends of the Teton and Robert Al-Chokhachy: USGS Rocky Mountain Science Center

From: Matthew Campbell, Ninh Vu, Dan Eardley, and Kelly Heindel; Eagle Fish Genetics Lab, IDFG and PSMFC

Subject: Genetic Results of screening Yellowstone cutthroat trout from the Teton River drainage

All,

We have completed an exploratory project to assess the genetic population structure of Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* in the Teton River drainage and to examine the feasibility of Genetic Stock Identification (GSI) for management and conservation purposes.

We extracted and attempted to genotype 683 samples from 17 sample collections. Samples were screened with a 168 single nucleotide polymorphic (SNP) marker panel. This panel includes 11 SNPs that are diagnostic between *O. mykiss* and *O. clarkii*, and a Y-chromosome specific assay that differentiates sex in *O. clarkii* (IDFG, unpublished data). Of the 683 samples, 127 failed to genotype at a minimum of 90% of the snps and were removed from the dataset. In addition, 5 pairs of duplicate samples were identified (1 of each was removed from the dataset) and 56 samples were identified as rainbow trout or hybrids and also removed from the dataset. The final dataset consisted of 495 samples (Table 1). Data summaries and formatting for specific genetic software programs was completed in R version 3.4.1 (R Core Team 2017).

We calculated observed and expected genetic diversity (heterozygosity) for each sample collection and tested for departures from Hardy-Weinberg equilibrium (HWE) using exact tests performed in the R package: Genepop (Rousset et al 2017). We adjusted the significance of P-value levels for multiple comparisons as described in Narum (2006) for 17 simultaneous tests (critical value = 0.015). We also used Genepop to test for significant allelic differentiation among populations and to estimate pairwise population differentiation (F_{ST}).

We used two methods of genetic clustering to assess the genetic population structure of YCT populations in the Teton River drainage. First, we constructed an Unweighted Pair Group Method with Arithmetic Mean (UPGMA) tree based on the pairwise F_{ST} values using the software program MEGA4 (Tamura et al 2007). Second, we used discriminate analysis of principle components (Jombart et al. 2008) using the R package adegenet version 1.3-1 (Jombart

2008, Jombart and Ahmed 2011) to estimate the number of genetic clusters and calculate individual membership probabilities.

To assess whether the existing SNP dataset exhibits enough genetic structure for assignment tests, we divided sample collections into two groups consisting of baseline samples and samples for genetic assignment. Baseline samples included collections from the following tributaries: Moody Creek-2015, Canyon Creek-2015, Bitch Creek-2013, S.F. Badger Creek-2015, North and South Leigh-2005/2015, Teton Creek-2015, Trail Creek-2015, Darby Creek-2015 and Fox Creek-2015. Samples used for genetic assignment came from mainstem sampling in the Teton River (S.F. Teton River-2011 and Upper Teton River-2011) and from temporal replicates collected from the same tributaries that were used in the baseline: Canyon Creek-2017, Bitch Creek-2011/2015, S.F. Badger Creek-2005 and Darby Creek-2017. For testing purposes, samples from Moody Creek-2015 were divided in half, with the first 22 samples used in the baseline and the second 22 samples used for assignment testing. Individual genetic assignments were performed using the software program Oncor (Kalinowski 2008).

Results-

Genetic diversity as measured by observed heterozygosity (Table 1) ranged from 20% (Fox Creek-2015) to 29% (Bitch Creek-2015). For SNP loci, the highest expected heterozygosity that could be observed is 50%. Diversity was generally lower for sample collections from the upper Teton River drainage compared to collections from lower in the drainage. All sample collections in the Teton River drainage exhibited less heterozygosity than what has been observed in YCT samples from Burns Creek in the South Fork Snake River drainage (~33%; IDFG unpublished data). This may be due to ascertainment bias, since the SNP panel was originally optimized using samples from Burns Creek. Comparisons of observed versus expected heterozygosity indicated that three sample collections deviated from HWE expectations. These collections included the S.F. Teton River (2011), one collection from Bitch Creek (2013) and the collection from South Leigh Creek (2015). All deviations indicated heterozygosity deficiency. A deficit of heterozygotes often suggests that the sample collection contains individuals from multiple populations (Wahlund effect; Wahlund 1928).

Pairwise genetic differentiation as measured by F_{ST} ranged from <0.01 to 0.26 (Table 2). Temporal samples from the same location generally exhibited low or no differentiation (e.g. Canyon Creek 2015 versus Canyon Creek 2017). All pairwise estimates of genetic differentiation among sample collections from different streams were significant. The highest levels of differentiation were observed between sample collections from upstream versus downstream of S.F. Badger Creek (F_{ST} = 0.09 – 0.26). This pattern of differentiation is exhibited in the UPGMA tree (Figure 3), which clustered sample collections from Moody, Canyon, Bitch, and S.F. Badger Creeks together, distinct from upstream sample collections that included North and South Leigh, Teton, Trail, Darby and Fox Creeks.

Discriminant analysis of principal components also supported the partitioning of genetic diversity in concordance with the geographic location of sample collections. DAPC partitioned individuals into one of four genetic clusters (Figures 3 and 4). Two of the genetic clusters (1-red and 4-orange) contain individuals that come from almost exclusively the lower Teton River (S.F. Badger Creek and downstream). The other two genetic clusters (2-blue and 3-green) contain individuals that exclusively come from sample locations in the upper Teton River (upstream of S.F. Badger Creek).

The genetic assignment of temporal replicates indicated that a high proportion of individuals assigned back to their respective population (Table 3). Overall concordance was 93% and ranged from 88% (Canyon Creek) to 100% (Darby Creek). Two mainstem collections were also assigned to the current baseline. Samples from the S.F. Teton all assigned back to sample collections downstream of S.F. Badger Creek, with the majority of samples assigning to the Bitch Creek collection (2013). Samples collected from the Upper mainstem Teton River all assigned to populations upstream of S.F. Badger Creek, with the majority of samples assigning back to collections from Darby Creek (2015) and Teton Creek (2015).

These initial results suggest that there may be sufficient genetic structure of YCT in the Teton River to allow managers to pursue GSI approaches to estimate the contribution of genetic stocks, or in some cases individual populations, to mainstem fisheries. It should be cautioned however, that sample sizes in the current baseline are small and a number of streams in the Teton River were not represented in this initial study. When sample sizes of baseline populations are small, the allele frequencies estimated from those samples may not accurately represent the true population allele frequencies. When contributing populations are unsampled, individuals will misassign, although likely to a nearby, genetically similar population.

My recommendation for this year would be to resample North Leigh, Trail, and Fox Creeks with a goal of sampling a minimum of 30 fish. If there are any additional major contributing tributaries that have not been sampled, I would recommend sampling those as well, with a goal of sampling 50 fish in each tributary. Finally, I would also encourage completing a blind study, where you send our lab ~10 samples from ~10 tributaries, without any metadata. We will genotype those samples and report genetic assignments back to you (both individual and mixture composition). This would be a nice test that would provide confidence to managers for using this baseline going forward for main-stem analyses.

Metadata and genetic data for this project are stored on our in-house Progeny database. In addition, we will upload all metadata and genetic data for this project to the publicly available FishGen database in the near future (http://www.fishgen.net/). If you have any questions, don't hesitate to contact me. Thanks,

Matt

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Table 1. Sample collection and sample size (N), Pedigree Name (used for inventory in our Progeny database), latitude and longitude of collection site, observed (H_O) and expected (H_E) heterozygosity and P-value associated with HWE test (NS = not significant).

Sample Collection	N	Sample Year	Pedigree Name	Latitude	Longitude	H_O	H_E	HWE^P
S.F. Teton River	24	2011	OclSFTT11C	43.83026	-111.85778	0.26	0.27	**<.005^D**
Upper Teton R.	18	2011	OclTETR11C	Multiple	Multiple	0.22	0.22	NS
Moody Creek	44	2015	OclMOOD15C	43.69602	-111.55471	0.24	0.25	NS
Canyon Creek	24	2015	OclCNYT15C	43.68613	-111.38409	0.25	0.26	NS
Canyon Creek	33	2017	OclCNYT17C	43.68562	-111.38189	0.26	0.25	NS
Bitch Creek	26	2011	OclBTCH11C	43.95171	-111.15101	0.27	0.27	NS
Bitch Creek	80	2013	MixBTCH13C	43.94361	-111.23966	0.27	0.28	**<.005^D**
Bitch Creek	28	2015	OclBTCH15C	43.96359	-111.1199	0.29	0.28	NS
S.F. Badger Creek	18	2005	OclSFBG05C	43.86027	-111.01712	0.28	0.26	NS
S.F. Badger Creek	30	2015	OclSFBG15C	43.86105	-111.03820	0.27	0.27	NS
North Leigh Creek	16	2005	OclNLEI05C	43.82464	-111.03782	0.26	0.25	NS
South Leigh Creek	29	2015	OclSLEI15C	43.8169	-111.00060	0.25	0.26	**<.005^D**
Teton Creek	30	2015	OclTETC15C	43.75822	-110.99545	0.23	0.24	NS
Trail Creek	18	2015	OclTRLC05C	43.55854	-111.06815	0.22	0.22	NS
Darby Creek	24	2015	OclDARB15C	43.67682	-111.04646	0.21	0.22	NS
Darby Creek	41	2017	OclDARB17C	43.67669	-111.05140	0.21	0.21	NS
Fox Creek	12	2015	OclFOXC15C	43.63637	-111.14749	0.20	0.19	NS

Table 2. Pairwise estimates of genetic differentiation (F_{ST}). Comparisons not significantly different are noted with bold, italicized font.

Moody 2015	Canyon 2015	Canyon 2017	Bitch 2011	Bitch 2013	Bitch 2015	SF Badger 2005	SF Badger 2015	N. Leigh 2005	S. Leigh 2015	Teton C. 2015	Trail 2015	Darby 2015	Darby 2017	
0.05														Canyon
0.05	***0.00***													Canyon
0.07	0.03	0.02												Bitch
0.07	0.03	0.03	***0.00***											Bitch
0.07	0.02	0.02	0.01	***0.00***										Bitch
0.08	0.04	0.04	0.03	0.03	0.03									SF Badger
0.08	0.04	0.04	0.03	0.03	0.04	***0.00***								SF Badger
0.18	0.13	0.12	0.10	0.09	0.09	0.10	0.09							N. Leigh
0.18	0.14	0.14	0.12	0.11	0.11	0.13	0.12	0.04						S. Leigh
0.22	0.18	0.18	0.15	0.14	0.15	0.17	0.15	0.07	0.03					Teton C.
0.21	0.18	0.18	0.15	0.14	0.15	0.16	0.15	0.08	0.04	0.05				Trail
0.26	0.22	0.23	0.18	0.17	0.18	0.20	0.19	0.10	0.06	0.07	0.09			Darby
0.26	0.23	0.24	0.20	0.18	0.20	0.22	0.20	0.12	0.08	0.09	0.09	0.02		Darby
0.25	0.22	0.21	0.17	0.17	0.18	0.19	0.18	0.12	0.08	0.05	0.08	0.10	0.11	Fox

Table 3. Individual genetic assignment tests performed in Oncor. Sample collections on the top row were included in the reference baseline. Sample collections in the left column were assigned to baseline samples.

	Moody 2015b	Canyon 2015	Bitch 2013	SF Badger 2015	N Leigh 2015	S Leigh 2015	Teton Cr 2015	Trail 2015	Darby 2015	Fox 2015	N	Conc.
Moody 2015	20	2									22	90.9%
Canyon 2017		29	3	1							33	87.9%
Bitch 2015		1	27								28	96.4%
Bitch 2011		1	25								26	96.2%
SF Badger 2005			2	16							18	88.9%
Darby 2017									41		41	100.0%
SF Teton 2011	1	4	19								24	
Up. Teton 2011						1	15	2	43	1	21	

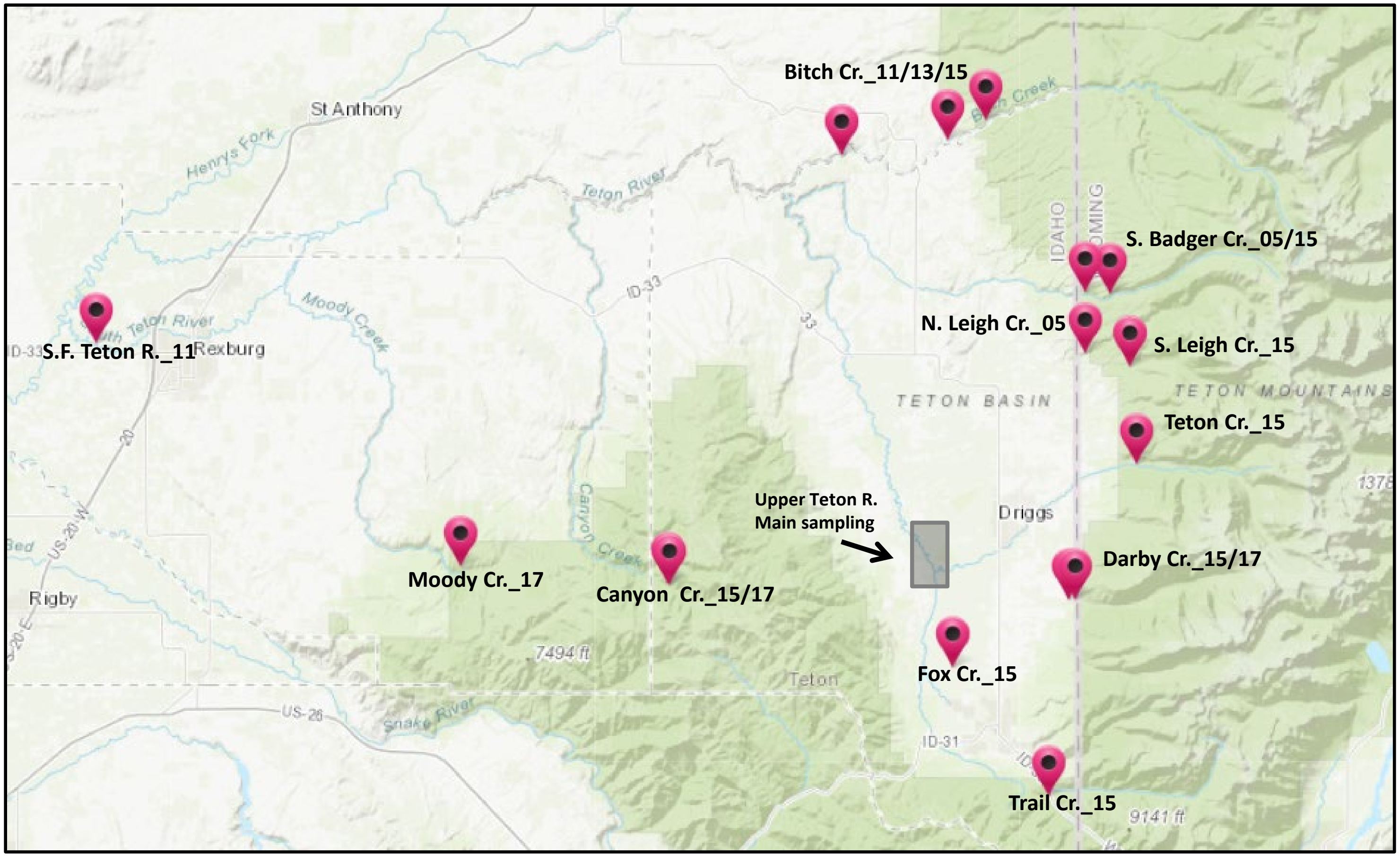

Figure 1. Locations of sample collections in the Teton River drainage.

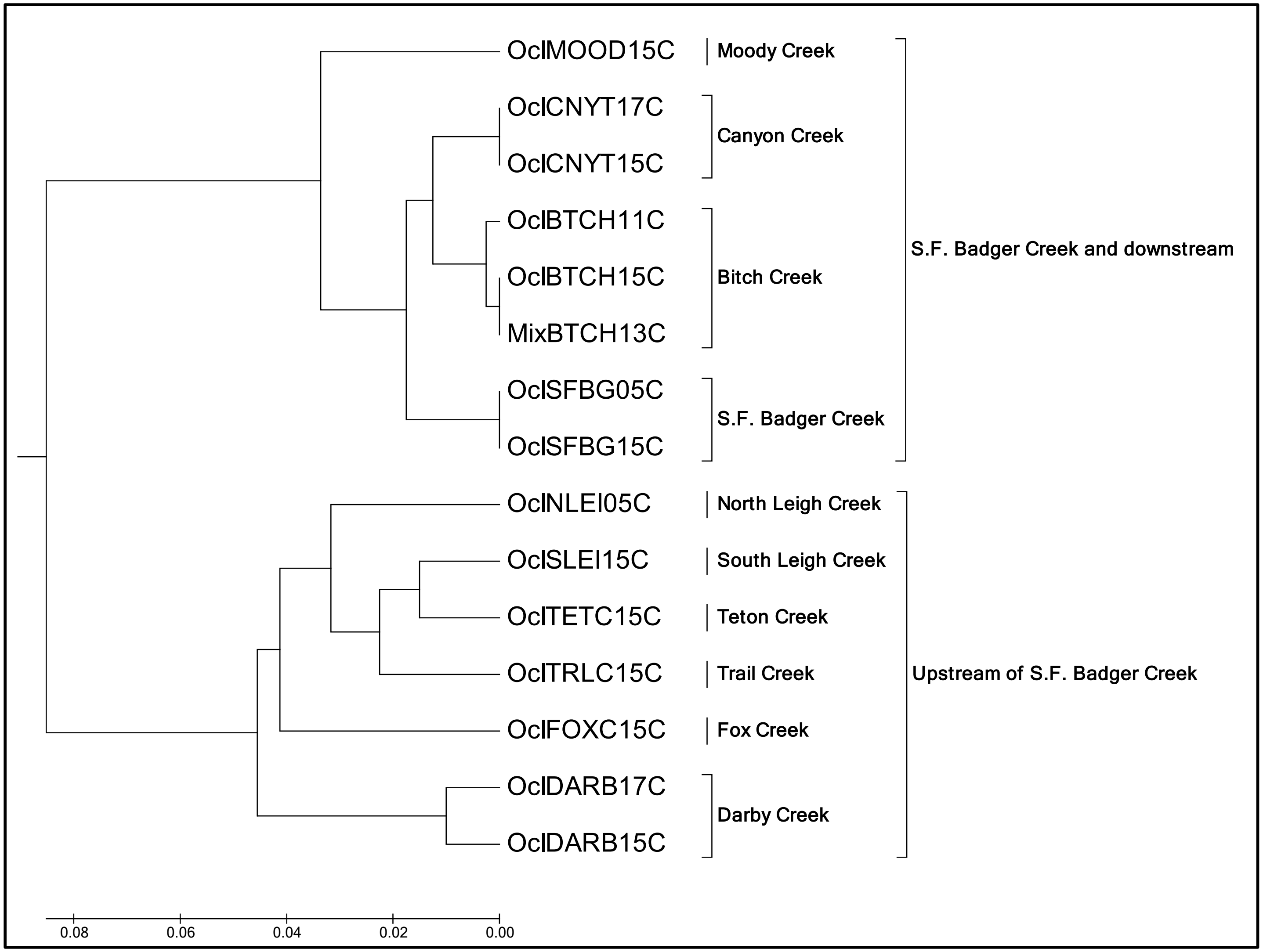

Figure 2. Genetic clustering of YCT sample collections from the Teton River based on pairwise F_{ST} estimates (Weir and Cockerham 1984) and inferred using the UPGMA method (Sneath and Sokal 1973).

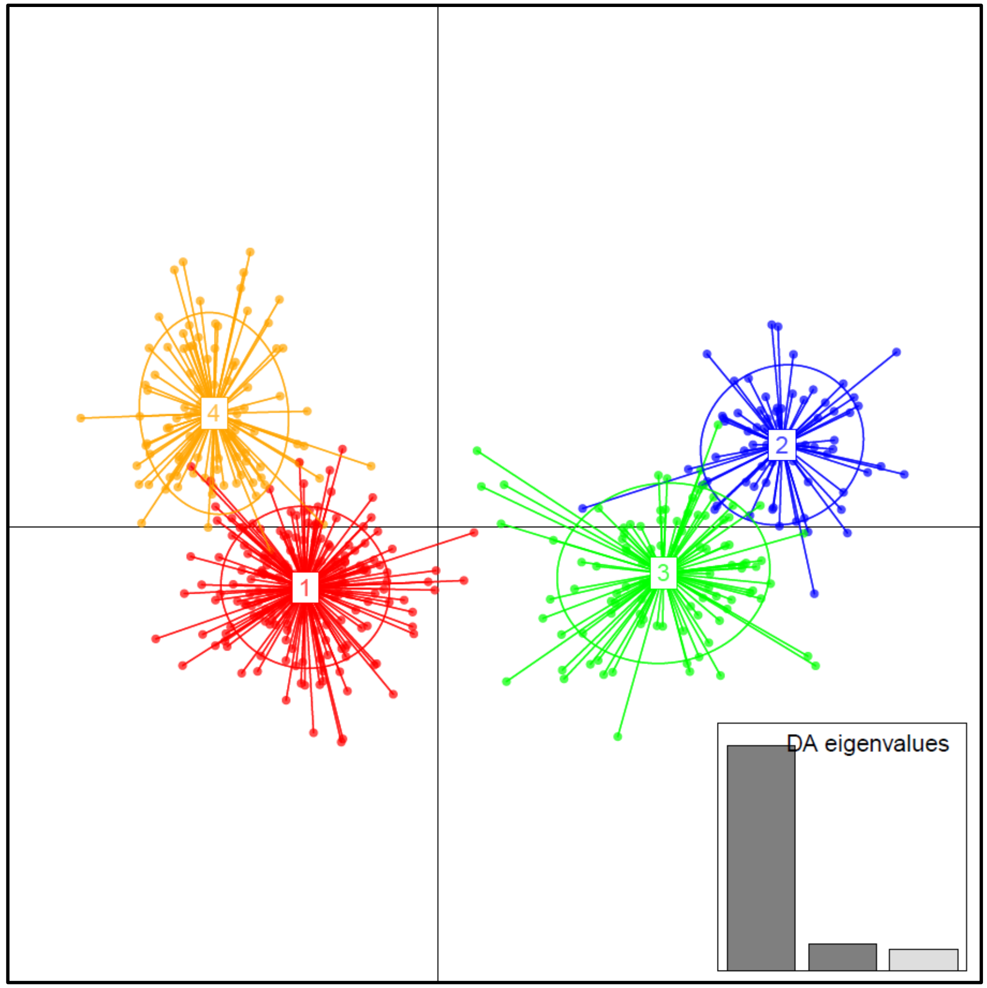

Figure 3. Discriminant analysis of principal components (DAPC) for all YCT genotyped in the study. Plot of the first two principal components obtained in the DAPC analysis reveals four genetic clusters. Each dot represents an individual and colors indicate their assignment to one of the four genetic clusters inferred by DAPC. The clusters 1 (red) and 4 (orange) contain individuals that come from almost exclusively the lower Teton River (S.F. Badger Creek and downstream). The clusters 2 (blue) and 3 (green) contain individuals that exclusively come from sample locations in the upper Teton River (Upstream of S.F. Badger Creek). The insert is the percent explained variance for the first three discriminate eigenvalues.

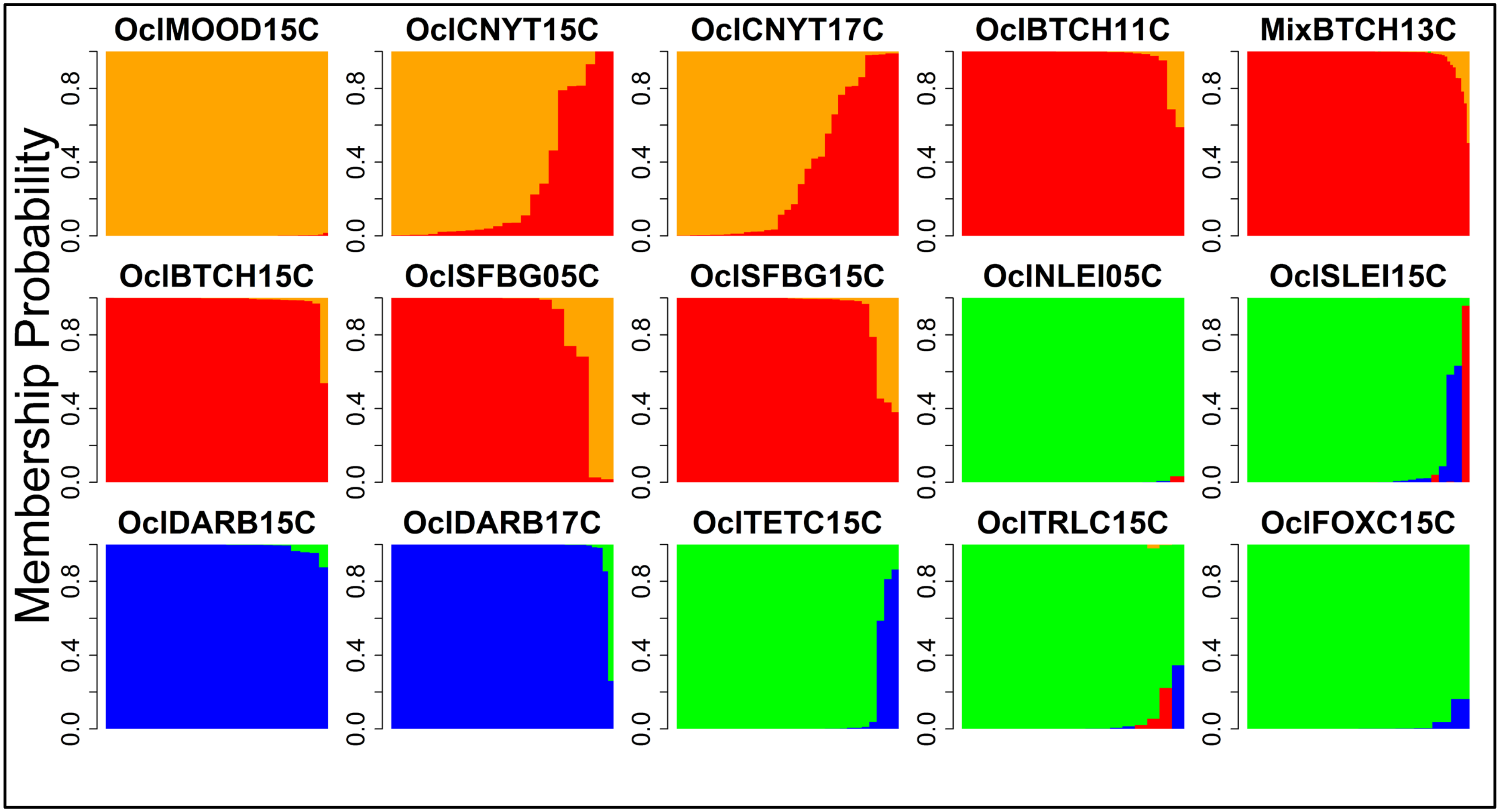

Figure 3. Barplots of membership probability for each sample collection. Each vertical bar represents an individual and its probability of membership to one of four genetic clusters (represented by the four different colors).

Attachment 6

The interactive effects of stream temperature, stream size, and non-native species on Yellowstone cutthroat trout

By

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Abstract

Climate change and non-native species are considered two of the biggest threats to native salmonids in North America. We evaluated how non-native salmonids and stream temperature and discharge were associated with Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) distribution, abundance, and body size, to gain a more complete understanding of the existing threats to native populations. Allopatric Yellowstone cutthroat trout were distributed across a wide range of average August temperatures (3.2 to 17.7ºC), but occurrence significantly declined at colder temperatures (<10 ºC) with increasing numbers of non-natives. At warmer temperatures occurrence remained high, despite sympatry with non-natives. Yellowstone cutthroat trout relative abundance was significantly reduced with increasing abundance of non-natives, with the greatest impacts at colder temperatures. Body sizes of large Yellowstone cutthroat trout (90th percentile) significantly increased with warming temperatures and larger stream size, highlighting the importance of access to these more productive stream segments. Considering multiple population-level attributes demonstrates the complexities of how native salmonids (such as Yellowstone cutthroat trout) are likely to be affected by shifting climates.

Key words: Yellowstone cutthroat trout, distribution, abundance, demography, temperature, non-native

Introduction

As a group, potamodromous salmonids of North America have experienced substantial declines in distribution and abundance (Penaluna et al. 2016). Currently, non-native species and a warming climate represent two of the greatest threats to the long-term persistence of many extant populations (Roberts et al. 2017; Wenger et al. 2011a). Warming climatic conditions are anticipated to have pronounced effects on salmonids (Comte et al. 2013; Kovach et al. 2016) as most species are stenothermic and reliant on cold water (Bear et al. 2007; Isaak et al. 2017a). While climatic shifts during the autumn, winter, and spring will undoubtedly have implications to salmonids, summer is expected to become progressively stressful as stream temperatures increase with warming air temperatures (Clews et al. 2010), which is likely to shift and reduce the suitable habitat for many species (Isaak et al. 2015; Jones et al. 2013). For montane areas such as the Rocky Mountains, the effects of a warming climate are likely to vary along elevational gradients (Al-Chokhachy et al. 2013) with cooler, headwater streams serving as key areas of thermal refugia (Isaak et al. 2015).

Numerous non-native species have been introduced across large portions of North America either intentionally for angling opportunities or unintentionally (e.g., Vander Zanden and Olden 2008). The establishment and expansion of wild populations of non-native species threaten native salmonids largely through competition, predation, and hybridization (Dunham et al. 2002; Muhlfeld et al. 2017; Warnock and Rasmussen 2013). These threats of non-native species are expected to be exacerbated by a changing climate (Rahel and Olden 2008; Wenger et al. 2011b). Warming temperatures often benefit non-native species with broader thermal tolerances than sympatric native species leading to further expansions of non-native distributions. Increasing stream temperatures are also likely to indirectly favor non-native species (Hitt et al. 2017; McMahon et al. 2007) by altering competitive interactions with native fishes (i.e., temperature-mediated competition; sensu Taniguchi and Nakano 2000).

Much of the existing species-climatic research in the western United States has focused on the distribution of fishes and not abundance or fish size (Isaak et al. 2015; Jones et al. 2013; Wenger et al. 2011b), likely due to the comparatively fewer estimates of abundance-particularly across large landscapes. A logical next step for many species is to consider how direct and indirect effects of climate change are linked with population characteristics known to be critical for persistence (Soule 1987). Understanding the concordance of species-stressor (i.e., climate, non-native species) relationships with population metrics (e.g., distribution, abundance, life-history) across broad geographic areas will enhance our understanding of factors controlling populations and better inform formal assessments of persistence.

Here, we consider how non-natives species, stream temperatures, flows, and landscape characteristics are associated with Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) distribution, abundance, and life-history (i.e., individual size). Yellowstone cutthroat trout is a sub-species of cutthroat trout native to portions of Idaho, Montana, Nevada, Utah, and Wyoming that, like many other native salmonids, has experienced significant declines in distribution and abundance (Gresswell 2011). The factors leading to these declines have been numerous, including habitat degradation and fragmentation and the deleterious effects of non-native species, which have contributed to extant populations occupying less than 45% of their historical distribution (Endicott et al. 2016). While populations of Yellowstone cutthroat trout continue to occupy a diverse range of habitats and demonstrate a variety of life-history forms including resident, fluvial, and adfluvial (Gresswell 2011; Meyer et al. 2009), cutthroat trout have a relatively narrow thermal tolerance (12 to 16 ºC; Bear et al. 2007) and are expected to be negatively affected by changing climatic conditions (Wenger et al. 2011b). Successfully directing conservation actions for salmonids such as Yellowstone cutthroat trout in a changing climate will require a robust assessment of threats limiting extant populations. To address this need, our objectives were to better understand 1) how stream temperature moderated the effects of non-native salmonids on Yellowstone cutthroat trout distribution and abundance; and 2) how stream temperature and stream size controlled the individual size of fish across a watershed. Considering multiple population-level attributes across a relatively large watershed using repeat sampling at fixed sites enabled us to evaluate the consistency of these relationships and heightened our ability to prescribe management actions.

Materials and methods

Study area

This study occurred in the Teton River basin in western Wyoming and southeastern Idaho (Figure 1). The Teton Basin (area = 2,886 km^2) is topographically diverse with elevations ranging from 1,482 m to approximately 3,460 m. Water temperatures, flows, channel gradients, and the presence and relative abundance of native Yellowstone cutthroat trout and non-native salmonids vary considerably across the basin (Table 1). The climate within the basin is typical for the Rocky Mountains with cold, relatively wet winter and spring months and dry warm summers. Precipitation occurs primarily as snowfall and hydrographs commonly peak in late spring and early summer and decline throughout the summer and autumn.

Several native and non-native species are present within the Teton River basin. In addition to Yellowstone cutthroat trout, native species include mountain whitefish (*Prosopium* *williamsonii*), sculpin species (*Cottus* spp.), mountain sucker (*Catostomus platyrhynchus*), bluehead sucker (*C. discobolus*), speckled dace (*Rhinichthys osculus*), longnose dace (*R. cataractae*), and redside shiner (*Richardsonius balteatus*). Non-native species include brown trout (*Salmo trutta*), rainbow trout (*O. mykiss*) and hybridized rainbow trout-Yellowstone cutthroat trout, and brook trout (*Salvelinus fontinalis*). In general, brook trout are most prevalent in the tributaries (n = 9 watersheds; n = 75 sites), rainbow trout and hybrids are locally abundant within some portions of the mainstem Teton River and larger tributaries (n = 3 watersheds; 18 sites), and brown trout occurred at relatively low abundance and only at one mainstem and one tributary site (Supplemental Figure S1).

Sampling design

For these analyses we included two different datasets within the Teton River basin. The first included fish monitoring sites that were systematically spaced (2-km interval between sites) across headwater tributaries. The headwater sites were established in 2005, when biologists from Friends of the Teton River (FTR) and partners developed and implemented the Upper Teton River Tributary Trout Population Assessment (Colyer 2006). The goal of this assessment was to monitor spatial and temporal trends in distribution and abundance of Yellowstone cutthroat trout and non-native species within the basin through repeat sampling at 5-year intervals. In 2010 and 2015, a collaborative effort from state agencies (Idaho Fish and Game and Wyoming Game and Fish), the U.S. Forest Service, Henrys Fork Foundation, and FTR resulted in a comprehensive sampling effort to repeat the sampling at the original 92 sites as well as a number of additional sites across the basin. A total of 128 sites were established (Figure 1), with the total number of sampling visits at each constrained due to resource and sampling limitations, resulting in 44 sites (34%) with 3 visits, 48 sites (38%) with 2 visits, and 36 sites (28%) with one visit and a total of

264 sampling occasions. The second dataset included long-term monitoring sites on the mainstem Teton River and South Fork Teton River (n = 4). While the long-term monitoring sites were initiated prior to the start of the tributary sampling, we included only those years available during the period of the headwater sampling and the number of visits varied by site (2 to 4), resulting in a total of 276 sampling occasions.

All tributary sites were sampled using either single or multiple backpack electrofishers, while mainstem sites were sampled with raft electrofishers. During field sampling, all fish were identified to species, measured and returned to the point of capture. To limit misidentification of species, we used phenotypic characteristics to delineate closely related Yellowstone cutthroat trout, rainbow trout, and potential hybrids, which has proven to be highly accurate in the region (Meyer et al. 2017). To avoid potential gear bias against smaller fish in larger rivers, we only included those fish ≥75 mm. We only included counts of individuals collected from the first-pass electrofishing surveys (i.e., relative abundance; hereafter abundance), as estimating abundance for species and sites with low densities is challenging (Al-Chokhachy et al. 2009). However, single and multiple pass estimates are usually highly correlated for trout species (Bateman et al. 2005), suggesting such difference are unlikely to significantly change our results.

Yellowstone cutthroat trout distribution analyses

We integrated the sampling data across years to better understand how attributes influenced by climate change (i.e., streamflow, stream temperature) and the abundance of non-native salmonids influence the distribution of Yellowstone cutthroat trout. Evidence of Yellowstone cutthroat trout extirpation or colonization at sites repeatedly sampled were extremely low in our dataset (5%) and occurred in allopatric and sympatric with non-native brook trout. Given such low turnover and high capture probabilities for Yellowstone cutthroat trout in small streams (Kruse et al. 1998), we used a generalized linear mixed-effects modeling framework (binomial distribution) with field measures of Yellowstone cutthroat trout presence or absence as the response.

Fixed effects included site-level measures of the abundance of non-native salmonids from the 1st electrofishing pass during each sampling event (i.e., relative abundance), stream temperature, streamflow, and gradient at each site. We totaled all non-native trout ≥75 mm within each visit and divided this by the site length, which differed by site across our study area. We then rescaled these site abundance estimates to compute the abundance of fish per km. Site-specific field estimates of temperature and streamflow were not available for all sites. As such, we used predictions of mean August stream temperature from the NorWeST model (Isaak et al. 2017b), which provides accurate stream temperature predictions (Isaak et al. 2010) and has been used extensively in salmonid distribution and conservation analyses across the region (Al-Chokhachy et al. 2018; Isaak et al. 2015). We matched the 1-km NorWeST temperature predictions with each of the sampling sites and used a recent decadal average in our analyses (2002 – 2011) to avoid potential biases from integrating shorter-term temperatures. We also included temperature as a quadratic term, given the relatively narrow thermal tolerances of salmonids and the consistency of salmonid distributions showing non-linear relationships with temperature (Isaak et al. 2017a; Wenger et al. 2011b). Despite these patterns, however, we also considered models without the quadratic temperature term, as it is unclear if our sample sites extended to habitats too warm for Yellowstone cutthroat trout. In addition to temperature, we included summer streamflow predictions from the Variable Infiltration Capacity model (Wenger et al. 2010) estimated for each NHDplus segment. Given the right-skewed distribution of summer streamflow at our sites, we log-transformed the values of streamflow to meet assumptions of normality. Finally, we controlled for differences in stream gradient at each site, as landscape characteristics can influence distribution of salmonids (Isaak et al. 2017a). We calculated gradient as the change in elevation (USGS DEM; https://www.usgs.gov/core-science-systems/ngp/national-hydrography) over the length of stream segments defined in NHDplus. Where multiple sampling sites occurred on a single NHD segment, we simply delineated the segment with equal intervals between sample sites and calculated the length of stream and change in elevation for estimates of gradient. For those sites where NHD segments continued upstream for >1km we limited the segment length and gradient estimate to the historic distribution as defined in the Yellowstone cutthroat trout Conservation Assessment (Endicott et al. 2016).

We included a nested random effects structure with sites nested within watersheds in our modeling framework. We defined watersheds based on local knowledge of distribution and connectivity of Yellowstone cutthroat trout and geomorphic similarities in habitat (Supplemental Figure S2). We specifically included the random effects to account for data from multiple visits at sites (see above) and to control for nonindependence of sites within watersheds and assumed the random effect were normally distributed. However, we do acknowledge that this approach was unlikely to account for autocorrelations due to the spatial location of sites within streams, which can inflate type-I errors. We included estimates of streamflow and gradient in all models to account for inherent differences in stream size and geomorphic setting across sites. Our candidate models included additive models for all fixed effects, except for stream temperature and non-native abundance, which we included as an interaction to investigate if temperature mediated the relationship between non-natives and the distribution of Yellowstone cutthroat trout. To allow for ease of interpretation, we standardized all fixed effects using z-scores (mean

= 0; SD =1). We initially considered random slope models to evaluate the potential differences in fixed effects across watersheds, but results indicated singular fit, so we proceeded with random intercept models only. We used Akaike Information Criterion adjusted for small sample size (AICc) to compare competing models and considered those models within 2 ΔAICc values of the top model as plausible models (Burnham and Anderson 2002). We performed our analyses in R (lme4 package, R; Bates et al. 2018) and considered parameters as significant if the 90% confidence intervals did not overlap zero.

Given the unequal number of sites where Yellowstone cutthroat trout were present (n = 102) or absent (n = 30) in our dataset, we adjusted the cutoff probability to maximize the accuracy and minimize bias associated with the unbalanced dataset (Cramer 1999). We evaluated the accuracy of cutoff probability values ranging from 0.5 to 0.9 (intervals of 0.05) and determined a cutoff value of 0.65 to be most appropriate for our analyses. We assessed the fit of the most-supported model using both area-under-the-curve (AUC) and measures of sensitivity (i.e., the proportion of sites where Yellowstone cutthroat trout were present and predicted as present) and specificity (i.e., the proportion of sites where Yellowstone cutthroat trout were absent and predicted as absent).

Yellowstone cutthroat trout abundance analyses

We evaluated factors associated with the abundance of Yellowstone cutthroat trout using a generalized linear mixed-effects model. Given our interests in climate attributes and non-native species relationships with Yellowstone cutthroat trout abundance, our fixed effects included stream temperature, streamflow and the abundance of non-native salmonids. We calculated the relative abundance of Yellowstone cutthroat trout and non-native salmonids (≥75 mm) as the total fish captured during 1st electrofishing pass of each fish sampling event (see above; i.e., abundance). Similar to our distribution analyses, we included a quadratic term for temperature and included estimates of streamflow in all models to account for differences in stream size across sites. Our candidate models included additive models for all fixed effects and interactions between temperature (linear and quadratic terms) and the abundance of non-native salmonids.

We included a nested random effects structure with sites nested within watersheds to account for nonindependence of sites due to within-population and geomorphic similarities (Supplemental Figure S2), and because most sites were visited more than once during our study. We included only random intercept models as random slope models indicated singular fit. We used a Poisson distribution to account for skewness that is common in count data (McCulloch and Neuhaus 1989) and assumed our random effects were normally distributed. After initial tests indicated overdispersion of the data, we added a random observation term to each model, which eliminated overdispersion. Again, we standardized all fixed effects using z-scores, compared competing models using AICc scores, and considered parameters significant if the 90% confidence intervals of the estimates did not overlap zero. We performed all analyses in R (lme4 package, R; Bates et al. 2018).

Individual fish size analyses

We evaluated linkages between stream size and temperature and the body size of Yellowstone cutthroat trout using quantile regression analysis (Cade and Noon 2003). For this analysis we merged all individual fish length data (≥75 mm) at each site with the NorWeST stream temperature predictions and average summer streamflow to better understand the importance of access to larger, warmer waters for Yellowstone cutthroat trout. For consistency with our distribution and abundance analyses, we log transformed the streamflow estimates from

VIC, and we standardized the temperature and streamflow predictions to allow for comparisons of parameter estimates. We assessed both additive and interactive models and considered the 0.9 quantile of fish size to infer of how temperature and stream size influenced the size of larger Yellowstone cutthroat trout size at different sites. Similar to our distribution and abundance analyses, we nested sites within basin to account for the fact that individual measurements at a site were not independent. We conducted the quantile regression analyses in R using the flexible qgam package and linear fixed effects (Fasioloa et al. 2017).

Results

Distribution of Yellowstone cutthroat trout

Our analysis indicated multiple plausible models (ΔAICc < 2) describing the distribution of Yellowstone cutthroat trout (Table 2). These top two models accounted for 75% of the model weights and included temperature, streamflow and the abundance of non-native species as well an interaction term with temperature and the abundance of non-native species. The 2nd most supported model included a negative quadratic temperature term indicating a reduced probability of Yellowstone cutthroat trout at increasing temperatures, but the parameter estimate had high variation around the estimate (B = -1.51, SE = 2.10). We present the results from the model with the most parsimonious structure (Burnham and Anderson 2002), which also had the highest Akaike model weight (W = 0.52; Table 2); we present the estimates of the 2nd plausible model in the online supplemental material (Table S1). The random effects structure indicated watershed effects (σ^2 = 1.78) accounted for 11.0% more variation than site-level effects (σ^2 = 1.62), suggesting that both watershed-level and site-level effects are key in determining the distribution of Yellowstone cutthroat trout. Overall accuracy of the top model was high (AUC = 0.98) with generally balanced and high measures of sensitivity = 0.92 and specificity = 0.91.

Our results indicated the distribution of Yellowstone cutthroat trout was positively related to temperature (standardized beta = 0.87; SE = 0.56; Table 3), negatively related to non-native abundance (standardized beta = -1.43; SE = 0.47), and positively related to the interaction between temperature and non-native abundance (standardized beta = 1.22; SE = 0.44; Figure 2). Together, these results suggest in the absence of non-native species there is a high probability of presence (P >0.75) of Yellowstone cutthroat trout regardless of average August temperatures. Concomitantly, the interaction term indicates that the probability of presence decreased with decreasing temperatures and conversely, increased at sites with warmer temperatures.

Abundance of Yellowstone cutthroat trout

We found two plausible models describing the abundance of Yellowstone cutthroat trout (Table 2). Both models included an interaction between temperature and non-native abundance suggesting the effects of non-native species varied across temperatures. We present the results from the top model, which also included an interaction between the quadratic temperature term and non-native abundance (Table 2), given the considerably higher Akaike weight (W = 0.40) and the consistency of these results with our data (Figure 3A). However, we do present the parameter estimates of the 2nd plausible model (W = 0.30) in the online supplemental material (Table S2). The random effect of watershed (σ^2 = 3.53) explained a considerably higher amount of variation in Yellowstone cutthroat trout abundance (211%) than random site (σ^2 = 1.67), suggesting greater importance of watershed-level attributes than observed in our distribution analyses. We found Yellowstone cutthroat trout abundance increased with warmer August stream temperatures up to 8 ºC and decreased as temperatures exceeded 12 ºC, as indicated by the quadratic temperature relationship between temperature and abundance (Table 3; Figure 3). In addition, we found a significant positive interaction between the abundance of non-native species and temperature (i.e., non-quadratic term) and a significant negative interaction between the quadratic temperature term and the abundance of non-native species. Together, our results indicate little differences in Yellowstone cutthroat trout abundance across temperatures in the absence of non-natives, but significantly lower abundance of Yellowstone cutthroat trout with increasing abundance of non-natives at colder temperatures (Figure 4).

Yellowstone cutthroat trout size

Our size analyses included 3,629 individual fish ranging from 75 mm to 571 mm (average = 245 mm). Given our data, we had clear support for one model as the ΔAICc was 6.5 between the top 2 models. The structure of the top model included an additive model with temperature and streamflow and we found strong evidence of the importance of streamflow (i.e., stream size; B = 42.1, SE = 6.3, P<0.001) and stream temperature (B = 30.7, SE = 664, P<0.001) and Yellowstone cutthroat trout size (Figure 5A, B).

Discussion

Concerns over the effects of a warming climate on salmonids stem from the relative narrow thermal tolerances, ecological importance of salmonids within and across ecosystems (Koel et al. 2005; Wengeler et al. 2010), and the socioeconomic values of this group of fishes (Brownscombe et al. 2014; Hughes 2015; Kerkvliet and Nowell 2000). The implications of climate change are likely to be complex (Crozier et al. 2008; Wenger et al. 2011b) and we must continue to revise our understanding of how native trout populations are linked with important climate attributes to enhance our capacity for effective conservation. These complexities are demonstrated by the different relationships with stream temperature and non-native species uncovered in our analyses. Specifically, we found that Yellowstone cutthroat trout occupied habitats with a thermal range of 3.2 ºC to 17.7 ºC from the distribution analyses; the highest measures of abundance occurred where August temperatures were 7 ºC to 12 ºC, but their abundances generally decreased as water temperatures increased. We also found that sizes of Yellowstone cutthroat trout increased in sites warmer temperatures where densities were commonly low, with the largest individuals typically at sites > 13 ºC, which we discuss below. We further discuss these patterns and their interactions with non-natives below.

Allopatric patterns of temperature and Yellowstone cutthroat trout

In the absence of non-native species, we found that Yellowstone cutthroat trout occurred across a broad range of temperatures in the Teton River basin (3.2 ºC to 14 ºC)—likely owing to the diversity of life-history forms present in this basin (Gresswell 2011; Isaak et al. 2015). The high probability of occurrence at cold temperatures <6 ºC are consistent with results from a largescale extensive analysis of different subspecies of cutthroat trout (Isaak et al. 2017).

Interestingly, our results indicated a high probability of Yellowstone cutthroat trout occurrence at temperatures approaching 18 ºC when including sympatric sites, and research in nearby populations in Wyoming indicate distributions may extend to even warmer temperatures (Isaak and Hubert 2004). Yellowstone cutthroat trout occurrence at warmer temperatures is not surprising as thermal-growth studies in laboratory setting suggest cutthroat trout exhibit positive growth up to nearly 20 ºC (Bear et al. 2007). However, our results are somewhat in contrast with previous studies indicating a "hump-shaped" or sharp decline in cutthroat trout distribution at warmer temperatures (Isaak et al. 2017; Wenger et al. 2011). For example, Isaak et al. (2017)

recently found the occurrence of cutthroat trout to be unlikely (i.e., probability < 0.50) as temperatures warm above 15.9 ºC (predicted August temperature; NorWeST). While we cannot rule out the use of thermal refugia (e.g., Ritter et al. 2020), preliminary temperature and fish capture data (Supplementary Material) have not identified extensive thermal refugia that may have biased our inferences. Consequently, it remains unclear what may be driving this difference, but it may stem from the different temperature relationships of individual subspecies of cutthroat trout (sensu Eliason et al. 2011). Alternatively, these differences may be due to the unique nature of the Teton River basin as habitats in the larger, warmer reaches of the river remain relatively intact. This pattern is different from many larger rivers where habitat fragmentation and degradation and invasive species have extirpated native salmonids (Nelson et al. 2002; Shepard et al. 2005). Undoubtedly, the distribution of Yellowstone cutthroat trout like other salmonids (see Kovach et al. 2016) will decline at increasingly warmer temperatures than observed in our study area. However, the covariation of increasing disturbance with warmer temperatures in many larger rivers may mask our ability to effectively identify temperature thresholds. Ultimately, this disagreement may suggest the challenges of applying larger-scale models to direct management actions at finer spatial scales.

In allopatry, Yellowstone cutthroat trout abundance was highest at temperatures ranging from 8 to 12 ºC with decreasing abundance at colder and warmer temperatures—a pattern consistent with previous cutthroat trout temperature-abundance studies (Huntsman et al. 2018; Isaak and Hubert 2004) and inferences from distribution analyses across the Northern Rocky Mountains (Isaak et al. 2017). The reduced abundance at colder and warmer temperatures reflects the growth potential of cutthroat trout (Al-Chokhachy et al. 2013) as forage opportunities and energetic consequences govern the potential biomass supported in these habitats (Jenkins and Keeley 2010). At higher-elevation, colder sites Yellowstone cutthroat trout abundance is likely further limited by recruitment limitations (Coleman and Fausch 2007; Peterson and Fausch 2003).

Temperature mediated effects of non-native species

Temperature commonly mediates the competitive advantages of sympatric salmonids (Fausch et al. 1994; Taniguchi and Nakano 2000) and can exacerbate the effects of non-native species (Franco and Budy 2005; McHugh and Budy 2005). Our results indicated the occurrence and abundance of non-native species reduced Yellowstone cutthroat trout distribution and abundances, but the effects varied across thermal regimes. At colder temperatures we found even moderate numbers of non-natives substantially reduced Yellowstone cutthroat trout abundance and distribution. With increasing abundance of non-natives, the probability of occurrence and abundance of Yellowstone cutthroat trout declined, a pattern concordant with previous research (Isaak et al. 2015). Non-native brook trout are the most prevalent non-native species in the colder reaches of the Teton River basin (Figure 3B). Brook trout commonly thrive in smaller, cold-water habitat (Taniguchi et al. 1998) and the mechanisms by which brook trout impact cutthroat trout include competitive advantages, growth efficiency, and earlier age at reproduction (Dunham et al. 2002; Kennedy et al. 2003). Brook trout as a non-native species commonly exhibit greater population abundance than native cutthroat trout, and cutthroat trout abundance is typically limited by brook trout abundance (Benjamin and Baxter 2012; Shepard 2010). In our study, brook trout abundance exceeded Yellowstone cutthroat trout at 86% of the sites where the species were sympatric, a pattern consistent with biomass data (Supplementary Material Figure S1). Higher abundances of brook trout in combination with low recruitment of cutthroat trout in cold habitats likely explains the reductions in cutthroat distribution and abundance (Dunham et al. 2002; Peterson et al. 2004; Roberts et al. 2017).

Regardless of non-native species abundance, the probability of Yellowstone cutthroat trout occurrence was high at warmer temperatures, probably owing to reductions in abiotic controls and enhanced recruitment (Peterson et al. 2004). However, abundance of Yellowstone cutthroat trout was reduced with even moderate increases in abundance of non-natives as temperatures increased. Brook trout and cutthroat trout have similar ranges of optimal thermal conditions (Wenger et al. 2011b) but brook trout often outcompete cutthroat trout at warmer temperatures (De Staso and Rahel 1994) reducing cutthroat trout survival, particularly at early life stages (Dunham et al. 2002; Peterson et al. 2004). In addition to brook trout, non-native rainbow trout are locally abundant at some warmer reaches in the Teton River basin (Figure 3B, Supplemental Figure S1). Rainbow trout have higher growth rates (Seiler and Keeley 2009) and broader ranges of thermal suitability than cutthroat trout (Bear et al. 2007; Wenger et al. 2011b). The presence of competitively superior non-native brook trout and rainbow trout undoubtedly reduce available resources (e.g., food, habitat) and thus limit the carrying capacity for Yellowstone cutthroat trout (sensu Jenkins and Keeley 2010). Furthermore, rainbow trout readily hybridize with Yellowstone cutthroat trout (Campbell et al. 2002; Gunnell et al. 2008), which erodes locally adapted gene pools, compromises early life-stage fitness, and facilitates gametic wastage (Allendorf and Leary 1988; Muhlfeld et al. 2009). Together, our results suggest the security of native Yellowstone cutthroat trout is substantially compromised in the presence of non-native salmonids, regardless of thermal regimes.

Importance of access to larger, warmer streams

Headwater areas may serve as critical climate refugia for cutthroat trout during the warmest periods, but our results also illustrate the importance of allowing fish access to larger, lower elevation, and warmer streams suggesting that conserving and maintaining access to these ecosystems may also be important. The strong positive relationship between fish size and both stream size and temperature is not surprising as larger rivers are often more productive and conducive to trout growth (Huntsman et al. 2016). Furthermore, lower-elevation, warmer streams have longer annual growing seasons when water temperatures promote growth (Al-Chokhachy et al. 2013). Accelerated growth in these mainstem habitats can lead to greater length-at-age and earlier age at reproduction for cutthroat trout (Budy et al. 2020; Huntsman et al. *In press*). Concomitantly, survival of adult Yellowstone cutthroat trout in larger streams can be higher than small, headwater streams where refugia from predators is minimal (Uthe et al. 2016). Larger, fluvial, Yellowstone cutthroat trout have considerably higher fecundity than smaller, resident individuals (Meyer et al. 2003), which likely increases the resilience of populations to perturbations (sensu Morita and Yokota 2002). While increased warming may reduce the suitability of some lower-elevation, warmer habitats during portions of the year, the mobility of cutthroat trout across seasons (Hodge et al. 2017; Sanderson and Hubert 2009) suggests individuals are likely to migrate to minimize thermal constraints and optimize metabolic demands (Armstrong et al. 2013).

We acknowledge that maintaining access to larger, productive habitat may not be feasible in all areas due to the imminent threats of non-native fishes and factors such as hybridization. Indeed, warmer temperatures in these habitats can exacerbate the threat of hybridization with rainbow trout and genomic extinction (Muhlfeld et al. 2014), and displacement by non-natives such as brown trout can be common (Budy and Gaeta 2018). Despite these threats, however, the high probability of occurrence of Yellowstone cutthroat trout in larger, productive stream reaches suggests the importance of these habitats, and illustrates the need to consider management actions to mitigate the threats of non-native species where conservation is a focus (e.g., Kovach et al. 2018). Where maintaining connectivity is possible, the occurrence of larger, highly fecund fish may also help offset some of the negative effects of non-native species such as brook trout in smaller, headwater streams (Adams 1999). Indeed, a post-hoc analysis of our data supports this notion in Canyon Creek where larger, fluvial fish persist and overall abundance of Yellowstone cutthroat trout is relatively high, despite higher-than-average abundance of brook trout. Further research is needed to better understand the tradeoffs of life-history diversity in the context of non-native species and climate change (sensu Peterson et al. 2008).

Watershed scale effects

Landscape attributes can affect the distribution and dynamics of salmonid populations (e.g., Armstrong 2005; Dunham and Rieman 1999; Kocovsky and Carline 2006), and we found watershed-level effects accounted for a considerable amount of the variation in Yellowstone cutthroat trout distribution and abundance. However, it is unclear if the effects of streamflow, temperature, and non-native species on Yellowstone cutthroat trout differed across watersheds, as more complex models were not possible in this study. Landscape attributes control the local factors important to salmonid population dynamics (e.g., local habitat, stream productivity; Armstrong 2005), which can moderate the relative strength of biotic and abiotic factors. For example, growth, a major component of fish production, is driven not only by temperature and discharge, but also habitat quality and forage (Ayllon et al. 2019; Rosenfeld et al. 2016). In addition, habitat conditions can affect the strength of competitive interactions between native cutthroat trout and non-native brook trout (Hilderbrand and Kershner 2004; Shepard 2004).

Collectively, this suggests that the implications of streamflow, stream temperature, and non-native species on Yellowstone cutthroat trout are likely to be driven by both site and watershed-level attributes.

Conclusions

Changing climatic conditions represent an additional threat to many salmonids already in peril (e.g., Almodovar et al. 2012; Roberts et al. 2013). Climate change is anticipated to result in considerable shifts in stream temperature, precipitation, and runoff patterns in the montane Rocky Mountains (Isaak et al. 2011; Luce and Holden 2009), which is particularly troubling given the strong coupling with salmonid life-history expressions and demography (e.g., thermal and hydrologic regimes; Jonsson and Jonsson 2009; Poff and Allan 1995). Effectively conserving and restoring imperiled populations will ultimately require formal assessments of the severity of threats confronting populations and species (Al-Chokhachy et al. 2018; Peterson et al. 2013). However, the scant resources available to managers requires them to prioritize management actions to conserve populations of native fishes such as Yellowstone cutthroat trout (Al-Chokhachy et al. 2018; Dunham et al. 2002; Peterson et al. 2013). Merging inferences from large-scale analyses (Isaak et al. 2017a; Isaak et al. 2015) with basin-specific analyses, as used herein, can provide a more comprehensive means to understand factors limiting Yellowstone cutthroat trout populations. In the Teton River basin, near-term predictions (2040s) from the NorWeST stream temperature model indicate the extent of habitat with average August temperatures exceeding 17.7ºC (the maximum temperature observed in our study) is likely to increase from 14.1 km (historic baseline; 0.7% of available habitat) to 75.1 km (3.6% of available habitat). Concomitantly, the amount of habitat where temperatures supported the highest Yellowstone cutthroat trout abundance (7ºC to 12ºC) is anticipated to decrease from 43% to 32% of available habitat by the 2040s. Considering such predictions in concert with local and watershed habitat conditions that can facilitate non-native success (Adams et al. 2002; Dunham et al. 2002; Shepard 2004) can provide a roadmap for enhancing the resilience of Yellowstone cutthroat trout (e.g., Peterson et al. 2013).

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Table 1. Median and ranges (in parentheses) for estimated gradients, mean August stream temperature, average summer streamflow, Yellowstone cutthroat trout (YCT) abundance, and non-native salmonid (brook trout, rainbow trout, brown trout) abundance across sample sites in the Teton River basin, in Idaho and Wyoming, USA.

	Yellowstone cutthroat trout	
Attribute[a]	Absent	Present
Gradient (%)	4.8 (1.5 – 17.6)	2.5 (<0.1 – 22.1)
August mean temperature (°C)[b]	8.7 (4.1 – 15.1)	10.3 (3.2 – 17.7)
Average summer streamflow (m^3*sec^{-1})[c]	0.49 (0.01 – 2.47)	0.87 (0.03 – 34.94)
YCT abundance (fish/m)	0	150 (10 – 530)
Non-native abundance	168 (10 – 790)	76 (50 – 101)

[a]Abundance from 1st-pass surveys (i.e., relative abundance).

[b]From the NorWeST stream temperature model (Isaak et al. 2010)

[c]From the Variable Infiltration Capacity model (Wenger et al. 2010)

Table 2. The analysis, model structure, degrees of freedom including the intercept, fixed effects and variance of random effects (df), Akaike Information Criterion (AICc) and ΔAICc values, and model weights (W) describing the distribution (top) and abundance (bottom) of Yellowstone cutthroat trout in the Teton River basin in Idaho and Wyoming, USA. Both analyses included a random effect structure with sites nested within watersheds and potential fixed effects included predicted average August temperature (*temp*[a]), a quadratic temperature term (*temp*^{2}), the abundance of non-native species (logged[b]; *non-natives*), predicted average summer streamflow (logged; *flow*[c]), and site-level gradient (logged). All fixed effects were standardized with a μ =0 and SD = 1.

Analysis	Model[d]	df	AICc	ΔAICc	W
Distribution	Temp*non-natives + flow + gradient	8	187.45	0	0.55
	Temp*non-natives + temp^2 + flow + gradient	9	189.42	1.97	0.20
	Temp + temp^2*non-natives + flow + gradient	9	190.25	2.80	0.14
	(Temp + temp^2)*non-natives + flow + gradient	10	191.08	3.63	0.09
	Temp + temp^2 + non-natives + flow + gradient	8	195.23	7.78	0.01
	Temp + non-natives + flow + gradient	7	196.92	9.47	0.01
Abundance[b]	(Temp + temp^2)*non-natives + flow + gradient	10	2434.99	0	0.40
	Temp*non-natives + flow + gradient	8	2435.59	0.60	0.30
	Temp*non-natives + temp^2 + flow + gradient	9	2437.19	2.20	0.13
	Temp + temp^2*non-natives + flow + gradient	9	2438.38	3.39	0.07
	Temp + non-natives + flow + gradient	7	2439.01	4.02	0.05
	Non-natives + flow + gradient	6	2440.79	5.80	0.02
	Temp + temp^2 + non-natives + flow + gradient	8	2442.78	7.79	0.01
	Temp + flow + gradient	6	2442.89	7.9	0.01

[a]From the NorWeST stream temperature model (Isaak et al. 2010).

[b]Abundance from 1st-pass surveys (i.e., relative abundance).

[c]From the Variable Infiltration Capacity model (Wenger et al. 2011).

[d]Symbol "*" denotes interaction and "+" denotes additive.

Table 3. The analysis and parameter, estimates, standard error (SE), and lower and upper 90% confidence intervals (CI) for the top models describing Yellowstone cutthroat trout distribution (top) and abundance (bottom) for the Teton River basin in Idaho and Wyoming, USA. Fixed effects included predicted average August stream temperature (*temperature*[a]), a quadratic temperature term (*temperature*^{2}), predicted average summer streamflow (logged; *flow*[b]), and the abundance of non-native salmonids (logged; *non-natives*), and site-level gradient (logged). All fixed effects were standardized with a μ =0 and SD = 1.

Analysis	Parameter[c]	Estimate	SE	Lower CI	Upper CI
Distribution	Intercept	1.72	0.56	0.90	2.91
	Temperature	0.87	0.58	-0.03	2.00
	Non-natives	-1.43	0.47	-2.33	-0.69
	Temperature * non-natives	1.23	0.44	0.60	2.10
	Flow	-0.24	0.42	-0.95	0.63
	Gradient	-1.04	0.56	-2.08	0.15
Abundance[d]	Intercept	1.94	0.54	0.97	2.82
	Temperature	3.10	1.45	0.70	5.51
	Temperature^2	-2.65	1.38	-4.95	-0.37
	Non-natives	-0.54	0.32	-1.07	-0.03
	Temperature * non-natives	6.10	2.65	1.77	10.47
	Temperature^2 * non-natives	-5.47	2.68	-9.95	-1.08
	Flow	0.35	0.29	-0.28	0.77
	Gradient	-0.29	0.34	-0.86	0.26

[a]From the NorWeST stream temperature model (Isaak et al. 2010).

[b]From the Variable Infiltration Capacity model (Wenger et al. 2011).

[c]Symbol “*” denotes interaction.

[d]Abundance from 1st pass electrofishing surveys (i.e., relative abundance).

Figure 1. The Teton River Basin (outlined in black) in western Wyoming and eastern Idaho, USA indicating the presence (grey) and absence (black) of Yellowstone cutthroat trout at tributary monitoring sites (circles) and long-term monitoring sites on the mainstem (squares). The inset shows the location of the Teton River Basin (black) in the Northern Rocky Mountains.

Figure 2. Results from the distribution analyses showing prediction probabilities (marginal effects using mean values for streamflow and gradient) for the presence of Yellowstone cutthroat trout where non-native species were absent (solid black) and at moderate (20^{th} percentile of data, 40 fish*km^{-1}; solid light grey) and abundant densities (80^{th} percentile of data, 300 fish*km^{-1}; dashed dark grey) against predicted average August stream temperatures (NorWeST stream temperature model, back transformed). Horizontal bold dashed line is the probability threshold (p = 0.65) given the unequal distribution samples where YCT were present or absent (see Methods).

Figure 3. The abundance (first pass catch per km) of Yellowstone cutthroat trout (YCT) in allopatry (hollow squares) and in sympatry with non-native salmonids (black squares; A) and non-native salmonids (B) including brook trout (white circles), brown trout (dark grey circles), and rainbow trout (light grey circles) against predicted average August stream temperatures from all surveys (i.e., including revisits) in the Teton River Basin in Idaho and Wyoming, USA.

Figure 4. A violin plot illustrating the abundance of Yellowstone cutthroat trout (from 1^{st} pass surveys) by different predicted average August thermal regimes (cold < 8.8 ºC, Cool =8.8 – 10.5 ºC, and warm >10.5 ºC) and where non-native salmonids were absent (white), in moderate abundance (1^{st} pass surveys; <50^{th} percentile of data, 120 fish*km^{-1}; light grey), and in high abundance (>50^{th} percentile of data ; dark grey) in the Teton River Basin in Idaho and Wyoming, USA. Violin plots depict the distribution and density of the data and the boxplots indicate the

median (horizontal line), the boxes represent the interquartile range (IQR), the whiskers are 1.5 times the IQR in addition to the IQR, and the points are outliers.

Figure 5. Individual length (grey circles) and marginal effects from quantile regression (black line; tau = 0.9; shaded region = 95% CI) for Yellowstone cutthroat trout captured during summer sampling and summer average streamflow from the VIC hydrologic model (natural logged; A) and the predicted average August stream temperature at each site (NorWeST stream temperature model; B) in the Teton River basin in Idaho and Wyoming, USA.

Figure 1

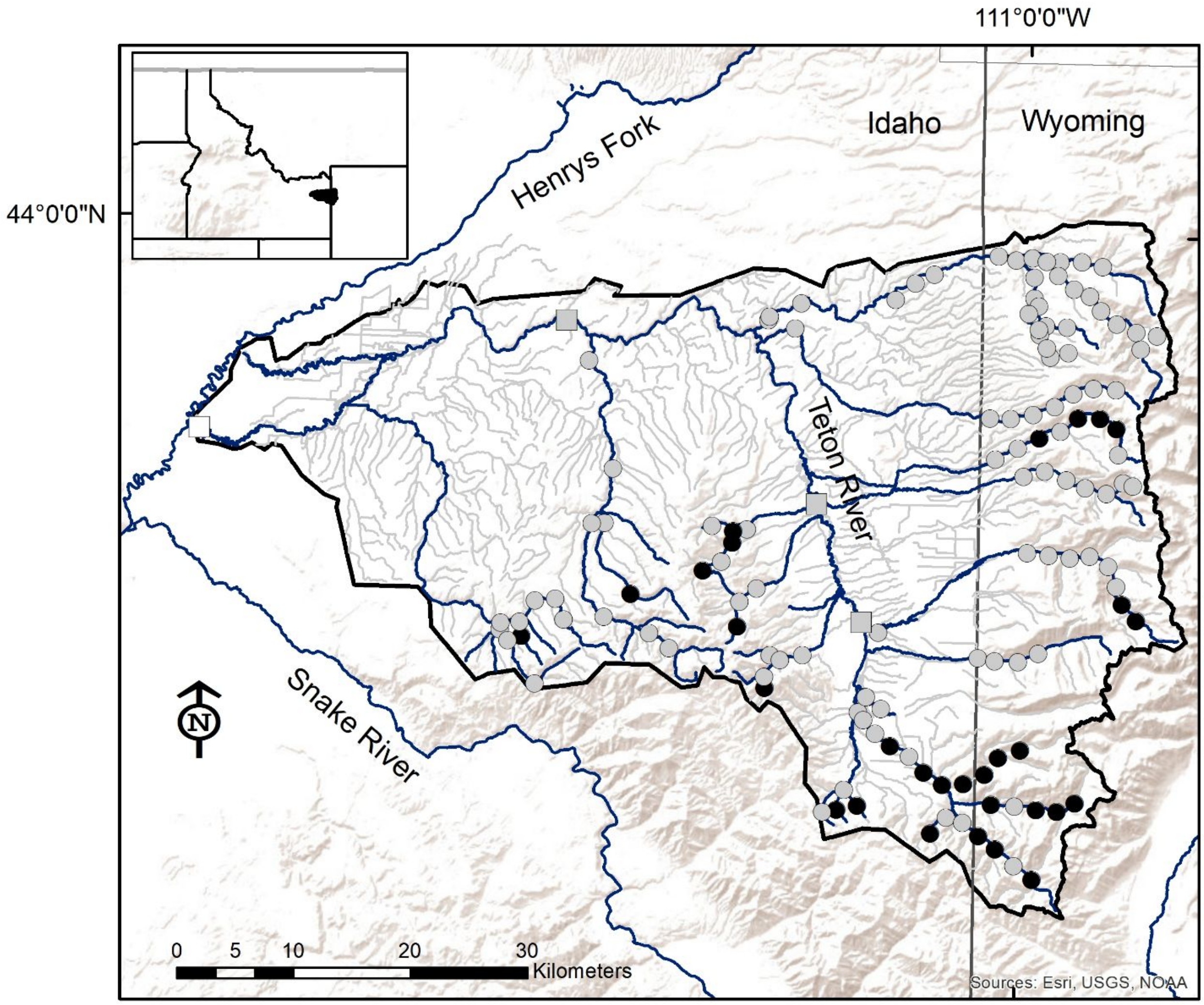

111°0'0"W
44°0'0"N
Henrys Fork
Idaho
Wyoming
Teton River
Snake River
N
0 5 10 20 30
Kilometers
Sources: Esri, USGS, NOAA

Figure 2

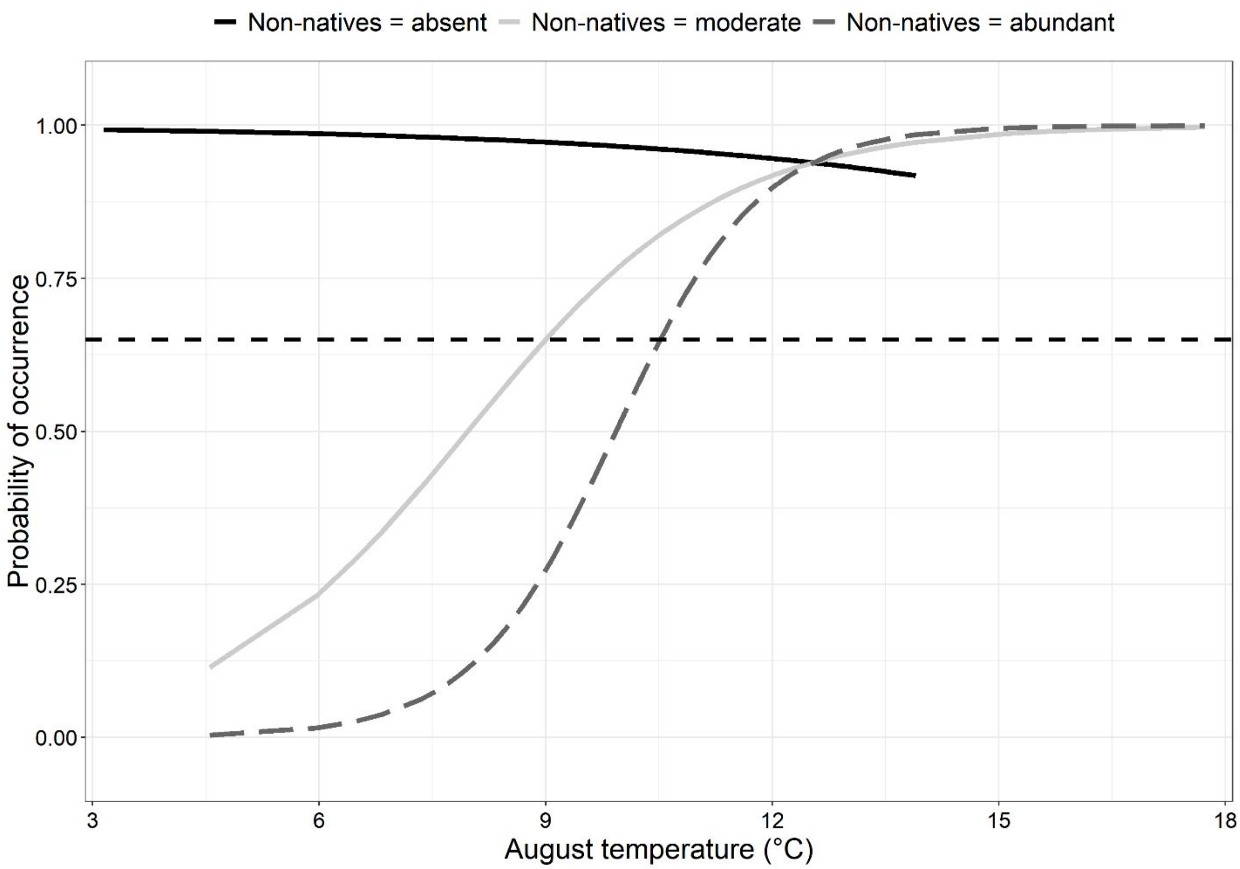

Non-natives = absent
Non-natives = moderate
Non-natives = abundant
1.00
0.75
0.50
0.25
0.00
Probability of occurrence
3
6
9
12
15
18
August temperature (°C)

Figure 3

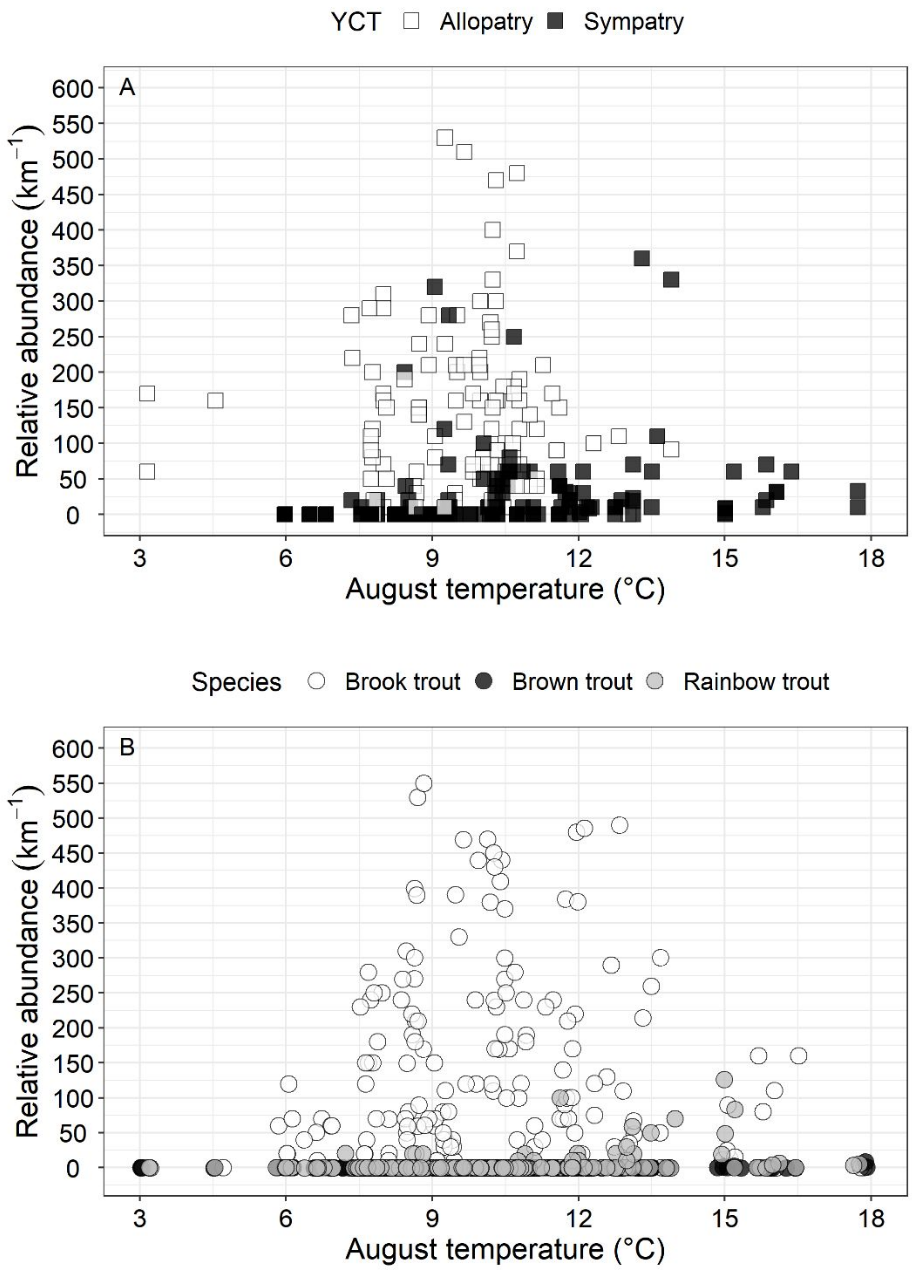

YCT Allopatry Sympatry
A
Relative abundance (km^{-1})
August temperature (°C)
Species Brook trout Brown trout Rainbow trout
B
Relative abundance (km^{-1})
August temperature (°C)

Figure 4.

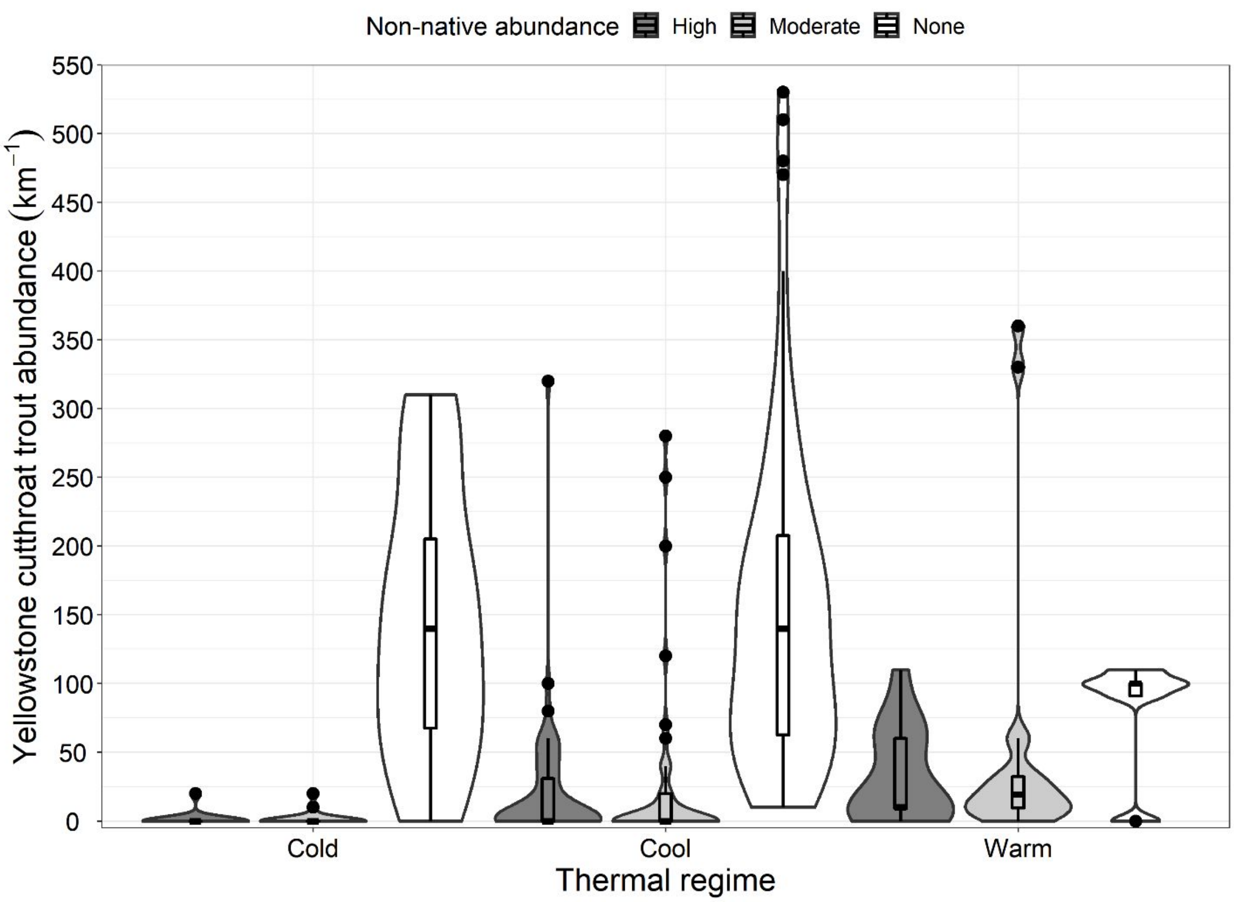
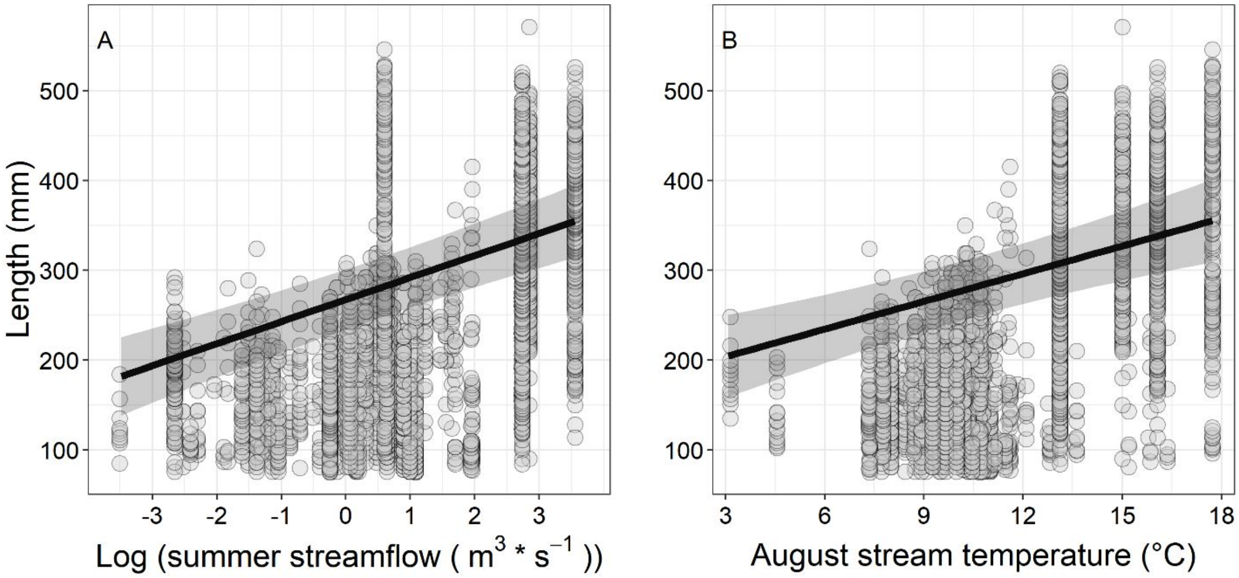

Non-native abundance
High
Moderate
None
Yellowstone cutthroat trout abundance (km^{-1})
550
500
450
400
350
300
250
200
150
100
50
0
Cold
Cool
Warm
Thermal regime

Figure 5


A
B
Length (mm)
500
400
300
200
100
-3
-2
-1
0
1
2
3
Log (summer streamflow (m^3 * s^{-1}))
3
6
9
12
15
18
August stream temperature (°C)